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Foundations of Mud Flotation.

It is obvious that the supporting power of foundations resting upon hard, unyielding material is more satisfactory in the long run than that offered by a material in some cases so yielding in nature that its supporting capacity is practically mud flotation. At the same time there are many places where rock or other unyielding material is at such a great depth that it cannot be reached for foundation purposes without excessive cost. In such cases, if the loads are not too large or if the loads are great, but capable of being distributed, it is entirely safe and feasible to utilize so-called mud flotation for entirely satisfactory foundations.

There are numerous places throughout this country where precisely that kind of foundation is employed to carry railway roadbeds, bridges, buildings and water-front structures, through and over which the heaviest freight traffic is carried. A considerable portion of the North River front of Manhattan Island exhibits a large amount of this foundation work of an eminently satisfactory character, where the pier or dock loads are assumed at 500 pounds per square foot in addition to the dead weight. Similarly many miles of timber railway trestles supported by mud flotation may be found along the gulf coast of the Southern States.

While there are many settlements of these structures, it is safe to say that there are few cases in which the character of the foundation does not indicate where such subsidence may reasonably be anticipated. If the material is excessively soft and the piles are easily driven, it is highly probable that settlement, especially under rapidly moving railroad trains, will take place. On the other hand, if the deep material has sensible tenacity or is not very soft, and if the loads carried by the supported structure are more nearly quiescent, the chances for sensible settlement may be so small as to be negligible. A large amount of the pier structures on the North River front of Manhattan Island are practically of this character, as are also a large number of bridge foundations in the Eastern and Southern States.

It goes without saying that every foundation question that either directly or remotely can be classed in the mud flotation category should receive the most careful consideration. Deep soft material, whether of silt or mud, or soft clay, or a combination of these materials, is not in itself eminently adapted to foundation purposes, and while it may in most cases be safely employed, the foundation should be so designed as to accomplish concurrently a number of purposes.

The supporting capacity of such deep soft material is commonly developed by driving long piles into it at as small distance apart as may be practicable, this distance seldom being less than 3 ft. with piles of the dimensions usually found in foundation work of magnitude. Two important results are thus attained, i. e., the soft material is much compressed and its frictional resistance is brought into action along the surfaces of the piles. It is evident that the point resistance is too small to be considered, and that the surface friction between the piles and the surrounding material must be the source of the supporting power of the foundation as long as the material penetrated does not move en masse.

The longest piles practicable should be used, since the total surface friction is thus increased, and for the further reason that the deeper the hold secured in the soft material the greater the supported load may become without the material being disturbed as a whole. This last feature of the case is of the highest practicable significance. The mass of material found within the area covered by the pile foundation becomes in a measure a body floating in its plastic environment. Assuming that the penetration of the piles will not be increased by the supported structure, it is at once apparent that the deeper the piles reach the greater must be the vertical loading required to produce lateral motion or flow below their points.

It is to be remembered, although it is frequently overlooked, that every horizontal square foot in the soft material sustains in its natural condition the material vertically above it. This means that the natural load resting upon each such square foot of area is not less than 1,000 lb. for every 10 ft. of depth, or 6,000 lb. at a depth of 60 ft. Under such circumstances it is obvious that unless the material is practically a liquid, or at least thin mud, a comparatively high abnormal loading will be required to produce the lateral motion necessary for sensible settlement. This feature of deep soft material is a sufficient explanation of the satisfactory character of its sustaining power as exhibited in many foundation works.

As a matter of fact, there are many locations in which the soft material acquires considerable tenacity and ceases to be very soft at depths not greater than 40 or 50 ft., and in which, if a pile be driven, it will require more than a hundred blows to reach a depth of 60 or 70 ft., the average of the last twenty or thirty penetrations being not more than 1 to 2 in. Although it is obviously only prudent to test the sustaining power of long piles in this kind of material before designing foundation structures for heavy loads, they may confidently be counted upon for a sufficient carrying capacity to assure a reasonable foundation structure. While there is a large amount of pile data available for engineering practice, quantitative information as to the safe carrying power of long piles driven into soft materials, as in mud flotation, is markedly scant. Data as to the supporting power of such piles drawn from tests of actual pile structures would be of the highest value.

The Importance of Considering the Contractor in Drawing Specifications.

The late Prof. J. B. Johnson, in his well-known work on "Engineering Contracts and Specifications," says: "Engineering specifications consist of a series of specific provisions, each one of which defines and fixes some one element of the contract. These clauses relate, in general: First, to the work to be done, second, to the business relations of the two parties to each other." It is naturally the aim of the engineer to secure for his client the best possible work at the least possible cost. The specifications are conceived and worked out primarily with this object in view. But in so far as the engineer shall fail to see and appreciate the bearings of each clause from the point of view of the contractor or bidder, he will fail to accomplish his purpose.

The young and inexperienced but conscientious engineer, in preparing his first specifications for any given work, will often try to copy from such files of specifications as may be accessible to him, all the clauses in each which seem to him best to protect the interests of his client, no matter how onerous or difficult of fulfillment they may be to the contractor. The contractor should not be expected to work at a loss, and he does not intend to, if he can help it. Consequently when he studies a set of specifications so compiled, he either refuses to bid at all, or else adds a large margin to the price at which he would have taken the work had the objectionable clauses been omitted. These objectionable clauses may, as stated by Prof. Johnson, be found among those which treat of the work to be done, or among those which define the business relations of the two parties to each other.

As an example of bad judgment in preparing specifications of the former class, may be mentioned the tendency, especially among younger engineers, to attempt to prepare special plans and designs for commercial articles such as boilers or engines, or for semi-commercial structures, such as bridges or towers and tanks. An engineer recently mentioned vividly the pains he took to design a tower and tank many years ago, and he believed that the contractor who finally succeeded in constructing the specially designed connections for the ties and struts and posts of that tower, has, if he be still on earth, some recollection of his own troubles. At that time there were comparatively few firms engaged in building towers and tanks, and the stock of standard designs for such structures was small, so that the engineer may, perhaps, not have been so much to blame for allowing himself to be to some extent carried away by his desire to do original work. Nowadays there are scores of reputable firms, each of which employs one or more thoroughly competent engineers, of special experience in the design of towers and tanks; and every firm has its own standard designs and patterns, and forms of connections in stock.

The engineer, therefore, who at the present day should prepare special plans for a steel tower and tank would simply waste his client's money. He could not reasonably hope to design as good a tower and tank as the majority of those which would be offered in competition if the bidders were permitted to figure on their own stock designs; and every bidder would, of course, be compelled to add to his price by reason of the extra work required by the engineer's special details. If, on the other hand, the engineer carefully specifies the nature of the material and workmanship, and furnishes the contractor with the principal data only, such as the capacity, height, maximum allowable stress per square inch on the various members of the structure, and then allows the bidders to submit their own designs accompanied by strain diagrams, he will not only thoroughly protect his client against inferior work or materials, but he will also be in a position to secure the best possible results at the least possible cost.

Coming next to the clauses which will usually be found under the heading "General" in specifications, and which treat for the most part of the business relations between the two parties to the contract, it is often apparent that the engineer has failed to recognize fully the fact that the contractor is entitled to consideration. It is true that it is the engineer's duty to protect his client's interests, but this can far better be accomplished by the judicious elimination of every unnecessarily onerous or harassing stipulation which is not of real importance. Many a contractor has shied at such clauses; and it is nearly always the most reliable and honest contractors who will object most seriously to what savors to them of injustice or a disposition on the part of the engineer to use his brief authority to their detriment. The unscrupulous bidder will not regard these stipulations so seriously, as he means to take short cuts that will enable him, he hopes, to make up for such losses as the objectionable clauses may cause him.

If the young engineer will only conquer his reluctance to display his ignorance by asking questions, and will, before making the final draught of his specifications, frankly consult with contractors in regard to the methods they expect to employ in doing the proposed work, he will be astonished at the amount of really valuable practical knowledge that he will gain. And if he will go further yet and try to ascertain the views of the contractors as to any clauses which he imagines might prove objectionable to them, he will thereafter be enabled to see those clauses from an entirely different point of view. And if he will then sit down and revise his specifications in the light of the knowledge thus acquired, he will not only secure low bids for his client, but he will at the same time have the satisfaction of feeling that he has given the contractor the square deal, to which he is always entitled.

Engineering Drawings.

It is about time for some of the engineering societies to discuss the general subject of drawings, for a tendency can be observed in several localities to revert to the old-fashioned plans the size of a bedquilt instead of reducing the size of the sheets and the amount of detail to the necessary minimum for working purposes. Years ago some of the best mechanical engineers in the country turned out drawings of small scale and exquisite finish, and there are a number of offices where this practice has remained in vogue down to the present time. On the other hand, there were some of the older civil engineers who used up a great amount of paper and draftsmen's time preparing drawings which were practically reproductions of the printed matter issued by various supply houses. The feeling seemed to be more or less prevalent that unless a report was accompanied by a considerable number of drawings, no matter whether important or not, the client would think that he was not getting the money value of his payments to the engineer. Accordingly a lot of wholly unnecessary drawing has come to be considered desirable.

Not only are more drawings often made than are useful to the contractor and resident engineer, the two persons for whose benefit they are made, but they are elaborated to such a degree that their value is greatly diminished for working purposes. Anybody who has tried to handle a big sheet of paper on a windy day does need to be told how much trouble these large drawings can cause, and probably every reader of this journal who has been engaged as a resident engineer on very much work has been forced for his own convenience to make small diagrams for actual field use from such large drawings. It is probably safe to say that a very large part of the drawings made to-day could be prepared of one-fourth to one-half the size that is commonly adopted, and still give just as much useful information to those for whom they are intended. In fact, many of them would be much clearer if made smaller and less confused with frequently repeated dimensions and conventional signs.

One reason for this needless size in engineering drawings is to be found in the scarcity of real skill among draftsmen. It is much more difficult to draw fine lines and make small lettering than the coarser product. It is more troublesome to lay out the work on a small scale, so that it will be clear and compact and not lose the results of the small scale by being distributed over a large sheet in little batches. Moreover, poor lines cannot be concealed by a lot of conventional signs on small scale drawings, for such signs can be used on very limited areas only.

It is worth while examining into this question in a good many engineering offices, for it will be found that a lot of money is being paid for drafting that has no value for anybody. Take the case of the general drawings for a power station. These are of limited importance, their main use being to give a general idea of the chief dimensions of the building and the location of the important apparatus. Nobody uses these drawings for the structural steelwork or for the details of the piping, yet it will often be found that draftsmen have been wasting their time to make the drawings almost equivalent to detail working drawings. In the same way the drawings of a manhole or a pump well or similar masonry structure are often elaborated with a degree of care and on a scale wholly out of keeping with the needs of contractors.

It has been said that one reason for making such large scale drawings as are now becoming fashionable again in some quarters is that they cost less to produce than their more reduced and better-drawn equivalents. This is questionable in most cases. The present tendency seems to be to fix the size of a drawing by the scale needed for the details, whereas the rational method would be to fix the scale of the general drawing as small as consistent with clearness of the general dimensions, and then give enlarged details where they are desirable. In this way the drawings will become of reasonable size and the enormous sheets which burden all who use them will be unnecessary.

The Operation of Sewage Disposal and Water Purification Works.

It is worth while to consider at the present time just how far it is justifiable for an engineer to put reliance on automatic apparatus in sewage disposal and water purification works. Anything that is designated by this term is too likely to be considered as certain in operation as the precession of the equinoxes. Once installed it is left to act as it will, and while it will often do well for a time, after it has been tuned up carefully by some competent engineer or superintendent, such good operation cannot be justly expected to continue forever. This fact seems to be forgotten by the authorities of many cities having sewage works or water purification plants, and the visiting engineer too, often finds that the operation of these systems leaves much to be desired.

The reason for the failure of municipal authorities to appreciate the importance of competent supervision of such works lies in part with their engineering advisers. The latter often fail to make clear that there is just as much need of careful operation of a sewage disposal system or a water purification plant as exists in the case of a steam engine. In fact, to secure the best results in some works of these classes a higher degree of skill and knowledge is required. There is ground for believing that the necessity for this supervision is not always impressed on the authorities when the works are completed. When the first economical spasm occurs in the administration, these disposal and purification works, which apparently run themselves and contain apparatus labelled automatic, are among the first to experience a cut in the appropriation. Being out of sight of most people and capable of running inefficiently for a long time without causing a nuisance or delivering a water that is noticeably bad, the authorities naturally consider that their action in reducing the appropriations for their operation was justified. That this is not the case is well known to those engineers who have visited many such systems.

The management of sewage disposal works, particularly when the effluent is discharged into a small body of water or one which is used in the vicinity for a public water supply, requires constant attention. This does not mean that a chemist of national reputation must be employed, but merely that the superintendent must have some knowledge of the action on the sewage which the works are intended to produce and the way in which that action is brought about in the various parts of the plant. He must know how to make simple tests and ought to be supervised by a consulting specialist who will detect promptly, from information in the superintendent's reports, all indications of erratic behavior. It should be impressed on the authorities that sewage disposal is a delicate process, affected by many conditions which seem trivial to the average citizen. Specialists who have devoted years to its study are frank to confess that in designing disposal works they generally allow for contingencies, so that they can shift the details of treatment from time to time as experience indicates to be desirable. These authorities on the subject do not consider that there is anything automatic about a disposal plant or that it will run without intelligent supervision.

The record of typhoid fever in a number of cities where water purification plants have been in operation is a strong demonstration of the necessity of supervising their operation carefully if the purification is to be prevented from degenerating into a farce. This subject is becoming more important every year, for the contamination of sources of water supply increases more rapidly than the population of the cities furnishing the polluting matters, and the population itself on many streams and watersheds is growing very fast. The supervision that such a plant requires is not expensive, even when it includes, as it should, the assistance of a consulting specialist, and it may save many cases of sickness, as well as result in economies in operation that may be effected by careful attention to details. This last saving is sometimes considerable in the course of a year, and at some plants expert advice has resulted in large reductions in operating charges.

Notes and Comments.

The Highest Hotel in America is to be erected on a 75 x 200 ft. plot of land running through from 32d to 33d St., New York. It will be just west of 6th Ave., and is to be completed about the same time as the new Pennsylvania station. The owner proposes to erect a 49-story building, although his architect, Mr. Mortimer C. Merritt, is understood to favor restricting the height to 40 stories. The owner's plans contemplate furnishing the highest grade of accommodations for 2,200 guests, half again as many as the Ansonia, the largest apartment house or hotel now open for business.

The London Building Ordinances have been modified lately in the interests of fire protection, nominally, although all that was done was to give authority to the surveyors of the various districts in the county to require suitable provisions for the escape of people from burning buildings. The surveyors are given the authority to order whatever improvements of this nature they consider desirable. If the owners object, they have the right of appeal to a tribunal of three members appointed by a Secretary of State and the councils of the Royal Institute of British Architects and of the Surveyors' Institute. The original draft of the bill contained many provisions concerning the construction of buildings, but these were not drawn with much tact and were rejected. It is understood that they will be introduced again, but if this is done it might be well to consider the new Prussian building regulations before drafting the bill.

The Valtellina Ry., the three-phase railway in Northern Italy, has now been running under steam railway conditions for more than three years. It is 66 miles long, and the sidings and other tracks bring the total single-track length up to 85 miles. The important fact demonstrated by the experience here is that the system is entirely practical. The average consumption of current has been 71.62 watt-hours per ton-mile, including every use of electricity on the line. Owing to the small number of trains operated, not more than five or six during the busiest service, the maximum peak load on the station is about three times the average. The average motor car or electric locomotive has been making 35,120 miles a year, about double the average run of steam locomotives on the system of railways of which this is a branch. The total cost of operation for current, repairs and train crews has been 60.6 cents per 1,000 ton-miles. The electrical equipment has shown unexpected durability and the inherent speed difficulties of three-phase motors do not seem to have caused any trouble in making time over the line.

Engineering Conquests have rarely been more quick and effective than that known as the Rhodesia Ry., a description of which is finished in this number. The story of its construction must recall to those who took part in them the early days of American transcontinental railway struggles. A very few years ago Victoria Falls was a mere geographical name to most of us, associated with swamps, crocodiles, and negroes bearing large, unwholesome assagais. To-day it is merely a railway station, with such ample hotel accommodations that in a few days the British Association will be holding meetings there. There are very few places in the United States where such a quick transformation has occurred, and there are very few roads which were as well built originally as this line that is heading for the Nile. The one feature that appeals to the American reader particularly is the excellent organization of the forces building and running the railway. With such an organization to amuse as well as direct the well employes, care for those who are sick, and keep all of them supplied with luxuries as well as necessities, it is not surprising that the rail end is being pushed north at a fast rate.

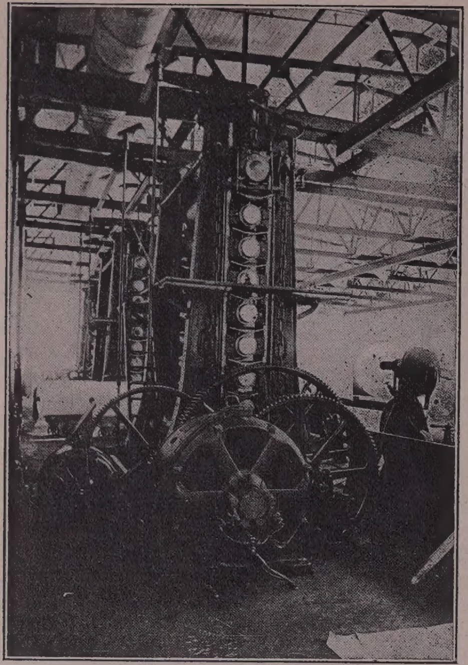
The Canton-Hankow Railroad has practically ceased to be an American enterprise, for on Aug. 29 the directors of the American China Development Co. voted to accept $6,750,000 for their property. The franchise for 746 miles of main line and considerable branch mileage would have been very valuable except for the fact that the concession was terminable at the pleasure of the Chinese government. After about thirty miles of track had been opened to traffic the government notified the company that the concession was terminated. Accordingly the property will be turned over for the sum named, and will hereafter be managed by the Chinese themselves. Many Americans have become acquainted with the enterprise through the interesting book on the preliminary surveys which was written by Mr. Wm. Barclay Parsons, who was president of the company until recently. These surveys were carried on in a province reported to be very anti-foreign in feeling, yet Mr. Parsons not only had no difficulties of any importance put in his way but was hospitably received by the officials and leading citizens whom he met.

The Superheated Steam Problem has been so intensified by the advent of the steam turbine that some definite data on the subject may be expected before long. The reports from one class of users, whose power plants carry a steady load, are most favorable; they are having no trouble to speak of and are satisfied with the results. There is another class, however, whose remarks on superheat are wholly unfit for publication. They have been trying to use high superheat with power units carrying loads subject to sudden and heavy fluctuations. The result of these is an occasional excessive rise in temperature, which causes all sorts of trouble in the piping and valves. It has even caused havoc in steam turbines, if numerous current reports have any substantial basis of truth. This is not at all surprising, for the clearances of turbines are very small, and the rapid and high rise in the temperature of superheated steam when a heavy load is largely thrown off with suddenness might reasonably be expected to cause overheating of the rotors and guides, with attendant binding. It is understood that the regulation of superheating is now receiving the attention of a number of specialists.

The Board of Water Supply of New York City is understood to be having considerable difficulty in securing men for its classified engineering positions, coming under civil service regulations. Although the work to be done by the Board is the greatest municipal engineering undertaking yet attempted in America, young New York engineers have a wide variety of important work open to them and are accordingly reluctant to go away from the city, which will be obligatory for most of the Board's staff. The extension of the subway railroad system, the great terminal improvements of the New York Central and Pennsylvania railroads and the regular work of the city departments offer such attractive opportunities for securing valuable experience within the city limits, that it is not surprising the out-of-town work of the Board is not particularly sought after. On the other hand, no young man interested in water-works affairs could ask a better opportunity than this for learning the details of engineering methods of the largest character in this specialty, and those who secure positions under Chief Engineer Smith may count themselves fortunate.

The Chicago Telephone Tunnels were constructed under more complete municipal control than was mentioned in the investigating commission's report printed in this journal on Aug. 26. In a report recently made by City Engineer Ericson he states that permits were properly issued for all work done on public property, and that weekly statements and monthly progress maps concerning the construction have been submitted by him to the Commissioner of Public Works. Mr. Ericson states further that the company's surveys were checked independently by his department, and the recent work has also been checked. The construction has been inspected by a representative of the Street Department, who gave all his time to the work, and also by Mr. Wm. R. Northway, a former city engineer of Chicago, who has devoted his entire time to this inspection since November, 1899, and has not considered it necessary to have any assistants. This statement seems necessary to show that Mr. Ericson's official duties in connection with the work have been fully discharged, a fact that might be misunderstood from a hasty reading of the report of the investigating commission.

The Panama Canal Situation has begun to furnish European caricaturists with subjects for some amusing sketches. It will be recalled that the last commission was dropped because, nominally, it did not accomplish anything. The new commission started in grandly, and Chairman Shonts announced early in its career that there would be great doings on the Isthmus as soon as he could get there. The impression was conveyed that as soon as he planted his feet on the little isthmus he would make dirt fly like a terrier pup in a woodchuck hole. Up to the present time the only things that have been flying about are excuses for not doing anything. These have been so numerous and varied that it is not surprising European professional humorists have seized upon them with glee. People acquainted with the Isthmian canal problem did not expect anything to be done, for no commission, however competent, could possibly take up the work of the excellent organization headed by Admiral Walker and carry it forward without a long period of delay in which to become familiar with conditions. The change in the personnel of the commission has caused a delay of a year in the work; everything of importance done at the Isthmus lately was provided for by the old commission, and the only thing the new organization has done that the old one did not has been to recognize more completely the deep interest shown by the administration in the details of the undertaking. It is to be hoped that these details are now sufficiently pleasing to pay the authorities for overthrowing one of the most level-headed, competent and efficient organizations ever developed for such a purpose. It is true that it did not say much to anybody except its employes, but its record of things done continues to grow brighter and brighter as the public becomes better acquainted with what it accomplished without any noise or newspaper notoriety.



Typical Calendar Drive.

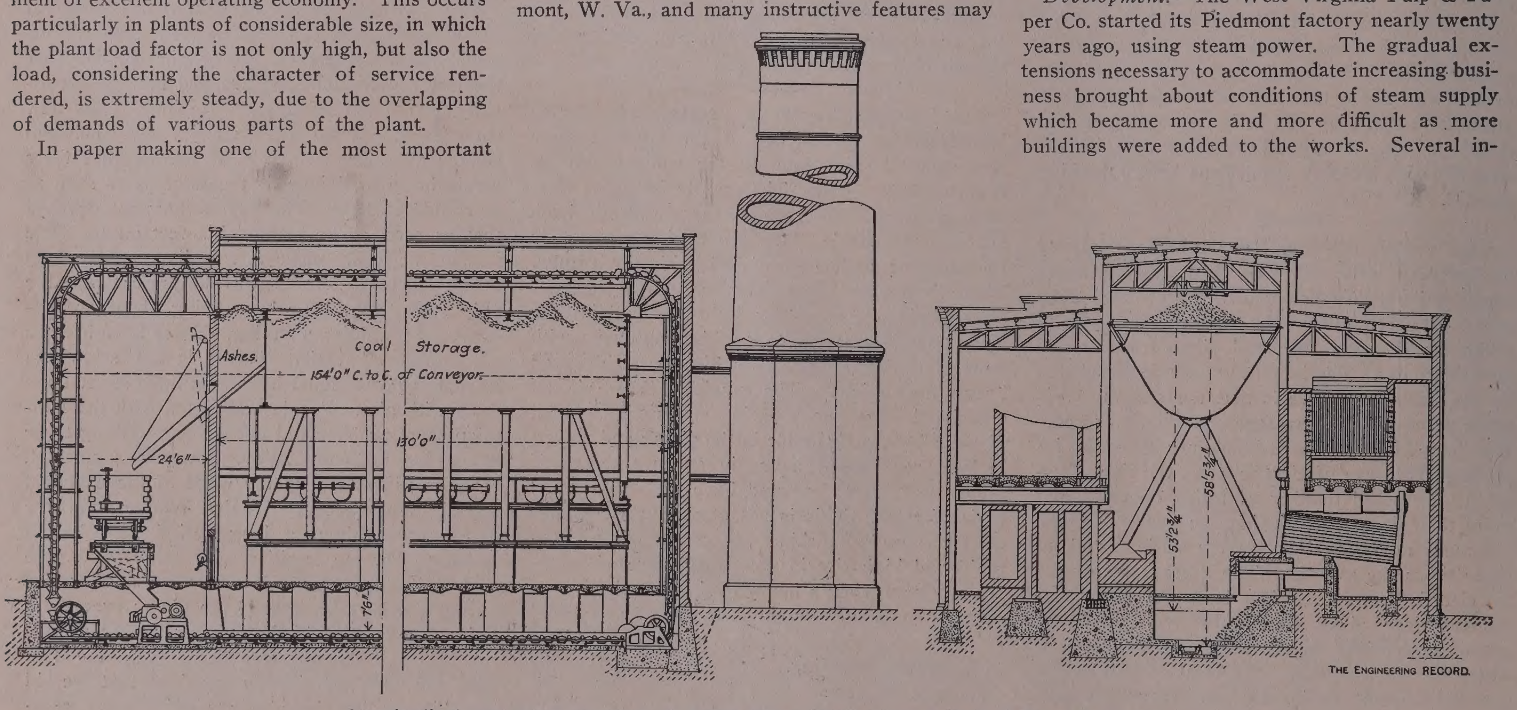
The Turbo-Electric Drive in Paper Mill Service.

The Experience of the West Virginia Pulp and Paper Co., Piedmont, W. Va.

By J. R. Bibbins.

Of the numerous fields in which the turbine has proved its general fitness as a prime mover, few present greater opportunities than that of pulp and paper manufacture. The general conditions surrounding a power service in paper manufacture are such as to be highly conducive to the attainment of excellent operating economy. This occurs particularly in plants of considerable size, in which the plant load factor is not only high, but also the load, considering the character of service rendered, is extremely steady, due to the overlapping of demands of various parts of the plant.

In paper making one of the most important requisites of a prime mover is continuity of service. In fact, so many fine points are involved in only a brief stoppage that in the exact words of a paper maker: "We would rather have a motor burn out or an engine ruined than to interrupt a run of high-grade paper." When once the run is started any alteration in speed, roll pressure or temperature seriously affects the quality of paper made. If such disturbances occur the roll must be broken, the defective make removed and a fresh start made through the rolls, which often proves a very troublesome matter. Hours, and not infrequently even an entire working day, are thus consumed in retrieving lost ground caused by a comparatively momentary disturbance.



Longitudinal and Cross Sections of Boiler Plant, West Virginia Pulp & Paper Company.

In no part of the power equipment of a mill of this character is sufficiency of design required more than in the prime mover. Its chief requisites for paper work may be summarized somewhat as follows:—

First, it must be able to operate continuously over long periods. Although the regular run of a single group of paper machines may not be long, the relaying of several groups of machines will necessitate a week's uninterrupted run during busy times.

Second, close speed regulation. With the adoption of electric drive in paper mill work the electrical regulation of both generator and the system depends largely on the speed regulation of the prime mover. The latter must, therefore, be relatively sensitive to changes in load.

Third, speed must be practically unaffected by wide variations in steam pressure, which are liable to occur at any time through one cause or another.

Fourth, high economy of steam, and hence of fuel, simply in the interest of low manufacturing cost.

Fifth, large overload capacity, in order to sustain occasional extra or superposed loads. A single set of machines working under increased speed or pressure might not seriously affect the power demand, but a number of them turning out the same stock might occasion an increase in load that would tax the power supply to its utmost.

By nature the steam turbine is particularly well suited to this class of work. How nearly it fulfills these various conditions may best be brought out in citing the experience with them in a large, strictly modern and high-class paper mill. Such a mill, one of several establishments operated by the West Virginia Pulp & Paper Co., is in operation at Piedmont, W. Va., and many instructive features may be observed. The Piedmont plant is of special interest on account of the complete conversion within recent years from distributed steam power to electric drive from a central power station. Its magnitude but lends additional weight to the commercial importance of the step taken. The present power plant supplies electric current, not only for power and for arc and incandescent lighting throughout the works, but also for lighting the streets and numerous company houses near by occupied by the workmen.

TABLE SHOWING EQUIPMENT DATA.

Station.
Service: Paper and pulp works.
System: 3-phase motor drives.
Capacity: Present, 3,600 kw.; ultimate, 4,600 kw.
Boiler plant, 7,200 b.h.p.

Building.
Walls: Hard pressed brick, steel frame. Inside finish, white glazed brick.
Roof: Steel trusses, tile and glass, monitor.
Floor: Concrete, steel frame.
Dimensions: Operating room, length 129 ft. 8 in., width 48 ft., height to trusses 40 ft.
Crane: Capacity, 15 tons; span, 47 ft.; hand power.

Turbine Plant.
Turbines: Two 1,000-kw. units.
Type: Westinghouse-Parsons, horizontal, 1,500 r.p.m.
Overload capacity: 50 per cent.
Dimensions of unit: 30 ft. x 7½ ft. x 8¼ ft. high.
Generator: Three-phase, 25-cycle, 440 volts, 1,500 r.p.m.
Exciters: 56-kw., 125-volts, driven by 85-hp. type C motor; 56¼-kw.; 125-volt, belted to simple engine.

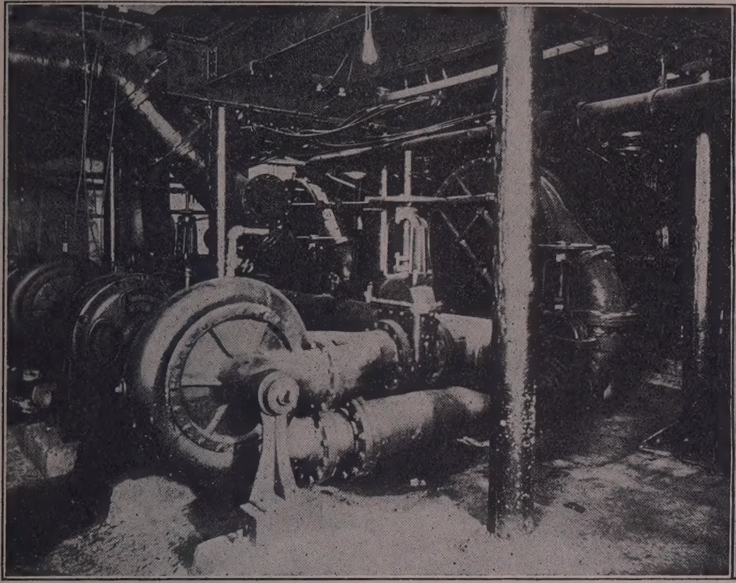
Engine Plant.
Engines: Two 800-kw. engine type.
Generator: Westinghouse revolving field.
Engine: 26 x 52 x 48-in. Hooven-Owens-Rentschler horizontal cross-compound Corliss.

Condensing Plant.
For turbines: Independent Alberger surface counter-current type, 4,000 sq. ft. each.
Circulating pumps: Two 10-in. Alberger, centrifugal, driven by 30-hp. type C motor.
Hot well pump: Reciprocating, automatic throttle valve.
Dry air pump: Two 8 x 16 x 16 x 12-in. tandem rotative type.
Vacuum: Normal at full load, 27 in.
For engines: Central barometric type, 24-in. column, Eynon & Evans, Philadelphia.
Dry air pumps: None.
Circulating pump: 10-in. R. D. Wood centrifugal, driven by 30-hp. type C motor.
Vacuum: Normal at full load, 26-in.

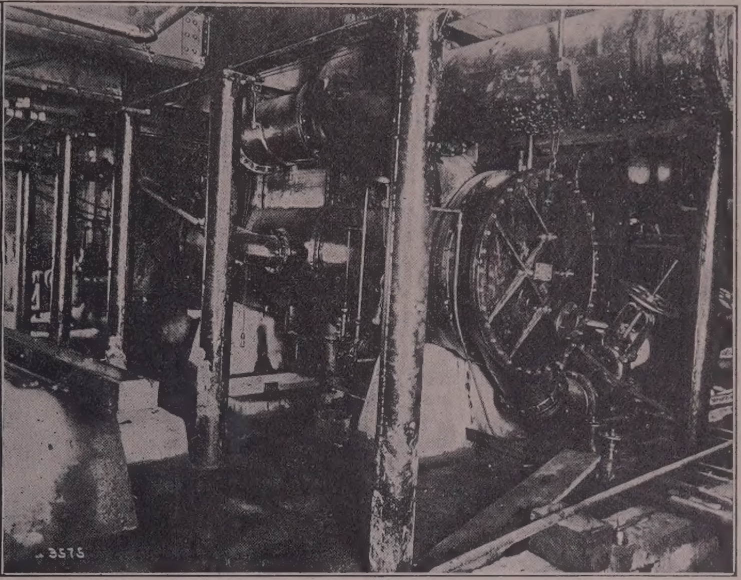
Boiler Plant.
Boilers: Twelve 600-hp. Edgemoor water-tube type.
Furnaces: Murphy automatic.
Economizer: Greene, on top of boilers.
Pressure: 160 lb., normal.

Electrical Plant.
Switchboard: Westinghouse 440-volt marble, 16 panels.
Round dial instruments, double bus, carbon break-circuit breakers.
Power factor and frequency meters.
Recording totalizing wattmeters.
Generator panels, four; feeders, six; lighting, 6; load, one.
Lighting service: 110 volts, separate from power; 100-kw. motor-generator unit.
Motors: Connected load, 4,920 hp., mostly Westinghouse types C and F.
  Three 400-hp. driving beaters.
  One 300-hp. driving beater.
  Three 250-hp. driving beaters.
  Nine 100-hp. driving paper machines, etc.
  Eight 75-hp. driving misc. machinery.
Drives: Group and independent.

Development.—The West Virginia Pulp & Paper Co. started its Piedmont factory nearly twenty years ago, using steam power. The gradual extensions necessary to accommodate increasing business brought about conditions of steam supply which became more and more difficult as more buildings were added to the works. Several independent boiler plants had to be established. Before the final conversion to electric power, there were no less than thirty engines operating independently in different parts of the plant. These ranged in size from 75 to 700 h.p., and comprised slow speed Corliss, simple high speed and a number of Westinghouse high speed compound engines, ranging up to 250 h.p. capacity. The latter type, being completely enclosed, proved particularly applicable in some cases, such as the chipping house in which the fine dust produced would render the operation of an open-type engine well nigh impossible. For the same reason the enclosed type gave good service in locations where acid fumes were encountered.

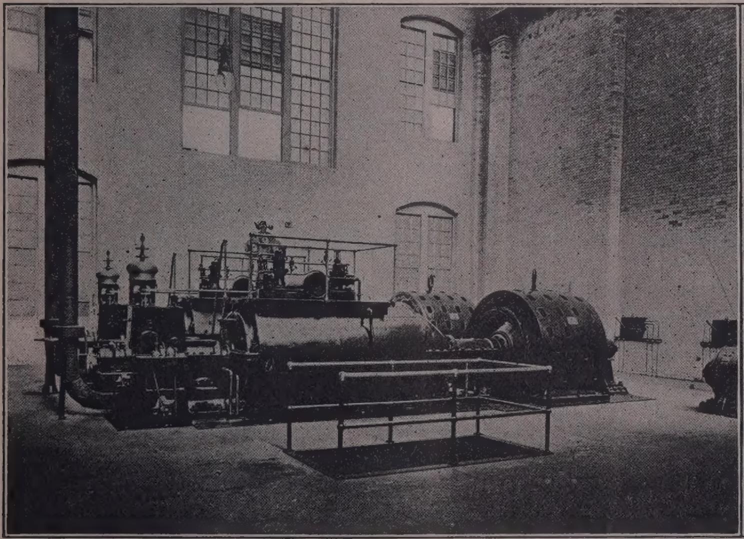


Pumps and Surface Condenser beneath Turbine.



Cast Iron Columns Supporting Turbine over Condenser.

On account of the well-known possibilities in the use of exhaust steam in paper making, a large number of small engines did not prove commercially uneconomical, but the floor area to be covered was so large that the difficulties attending the supply of steam became extreme. This finally led to the abandonment of the steam system. In the case of one engine drive, a pipe run of 900 ft. in length was necessary. With such conditions of distribution the maintenance of normal steam pressure became at times impossible, particularly during cold weather. The average pressure at the various engines was about 135 lb. If this pressure fell to 100 lb. serious trouble ensued in the manufacturing process; even a drop of 10 lb. was noticeable. As an example of the increased effectiveness of the new plant, on one occasion the pressure dropped from the normal of 150 lb. to 75 lb., but the electric power plant maintained its full load and speed.



General View of Turbine Installation.

Motor Driving Beaters on Floor Above.

In the reconstruction of the power system all the old engines were removed, piping torn out and boiler plants dismantled. A new central boiler and power plant was in the mean time erected, cable work laid, and step by step the machinery was turned over to electric drive. At the present time this central power plant is the only source of supply for the entire works.

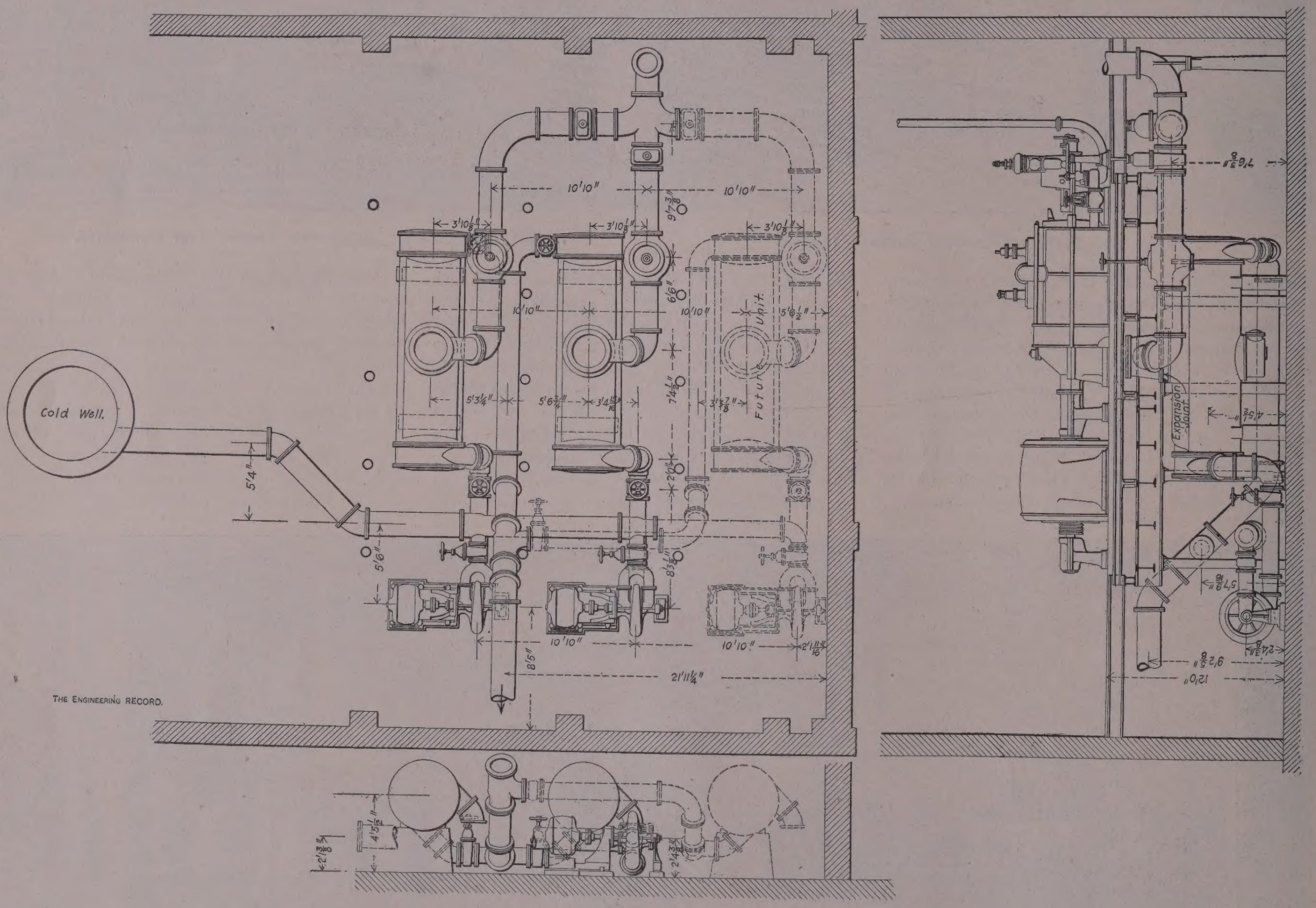
The Power Station.—Located as it is, practically in the center of the group of buildings comprising the works, the power station is most effectively situated with reference to the supply of heavy currents in all directions. High voltage distribution has, therefore, been unnecessary. In conformity with the character of construction of the more recently erected buildings, fireproof construction has been employed throughout, largely concrete-steel. A very attractive engine room has been secured through the use of white glazed brick on walls and pilasters and a wide expanse of wired glass in the roof, which, together with a liberal monitor, occupies fully two-thirds of the roof area. The table of equipment on page 254 shows at a glance the apparatus installed, only the special features of which will be commented upon.

The power house was originally laid out for horizontal, cross-compound, Corliss engine units, but the rapid increase in demand for power made it advantageous to employ steam turbines in order to avoid extending the present building as little as possible. Approximately one-half of the power plant is occupied by two 800-kw. engine-driven units. The remaining half is now occupied by two 1,000-kw. turbine units, with sufficient space left for another turbine unit of the same capacity. Proportioning the power house for the engines and steam turbines, the comparative floor space occupied is 5.25 and 1.53 sq. ft. per kilowatt for engine and turbine equipments respectively, including switchboards, condensers and auxiliaries.

Outside of the extraordinary compactness of the turbine unit itself, the arrangement of the condensing system has contributed largely to the general compactness of the turbine plant. Each turbine has it own independent condenser outfit, which is located directly beneath it between the columns forming its foundation. This allows a spacing of 10 ft. 10 in. center to center between the turbine units, with ample working space both on main floor and basement. In the accompanying photographs the very simple foundations necessary are clearly shown. These consist simply of 8 in. cast iron columns with 20 in. I-beam stringers beneath the bed plates and 15 in. cross beams, the whole structure being thoroughly riveted and anchored to the general floor structure at the two ends. Each pillar foots on a steel grillage resting on hard pan. The necessary rigidity is further insured by the concrete arch floor construction.

Turbine Plant.—Both turbine and generator construction conforms to the familar standards of the builders, the Westinghouse Companies, of Pittsburg, Pa. The unit was guaranteed to deliver an electric horse-power-hour on 15.7 lb. of dry steam. During a shop test the turbine economy fell below this figure, viz., 14½ lb. per brake-horse-power per hour at full load, saturated steam, slightly wet, 149 lb. steam pressure and 27.02 in. vacuum. As the efficiency of this size of generator ranges between 95 and 96 per cent., the unit is capable of delivering a kilowatt-hour under these conditions with close to 20 lb. of steam. Over a wide range of load the economy is nearly constant, e.g., at 825 and at 2,092 h.p.—two-thirds and one and one-half rated load respectively—the same water rate was observed, 15.9 lb. Moreover between these loads this water rate varied less than 0.9 per cent. Excellent speed regulation was obtained on test, 1.42 per cent. from no load to full load and 2.65 per cent. from no load to 50 per cent. overload.

The turbine unit is capable of sustaining large overloads through the assistance of a secondary admission valve, which operates in synchronism with the main admission valve, both under the control of the governor. During normal loads the main valve controls the steam admission; the secondary valve comes to its assistance on overloads.



Condenser Piping West Virginia Pulp & Paper Company.

The speed of the unit is readily changed while the machine is running by a simple screw adjustment on the governor spindle. In practice this is used for distributing the alternating current load in the proper proportions between the several units operating at one time. It may also be used for synchronizing them, but the latter is usually done largely by the throttle or by holding down the governor slightly. With the assistance of a rotary synchronizer, mounted on a swinging arm at the switchboard, the synchronizing of turbines and engines becomes an extremely simple matter, owing to the uniformity of rotation of the former. In order to protect the turbine against accidentally destructive speeds, an automatic safety stop is mounted at the end of each turbine shaft. This apparatus was tested by holding down the governor until the speed rose to the desired point. At 14.4 per cent. over speed the stop operated and shut off steam to the turbine.

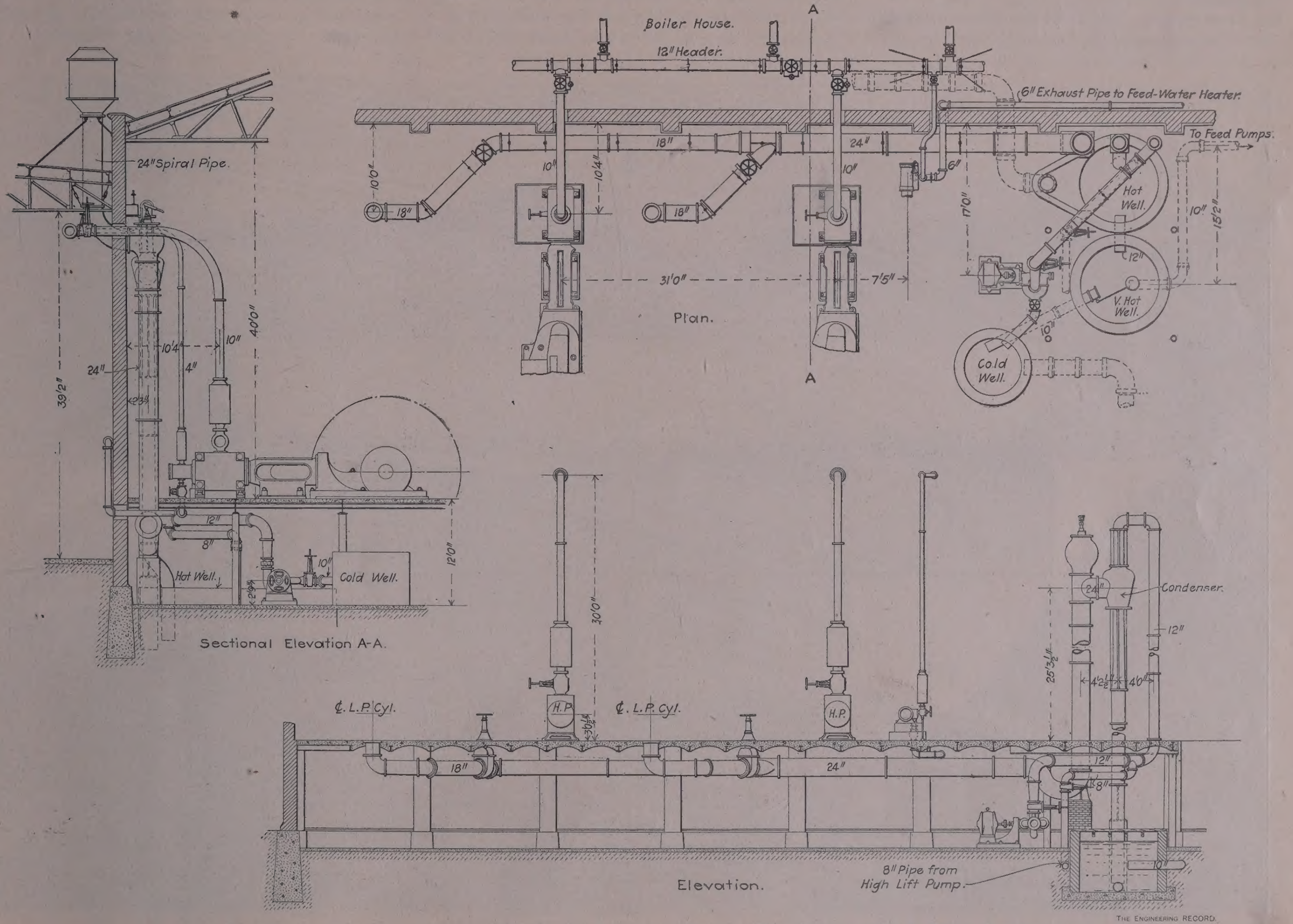
Condensing Plant.—Two types of condensers are in use in this plant, viz., the elevated jet or barometric type without dry air pumps and the counter-current surface type with dry air pumps. The former serve the reciprocating engine section of the power plant at a vacuum of 27 in. down, according to the water temperature, and the latter the turbines with 27 to 28 in. vacuum. In order to secure the direct delivery of the steam from the turbine exhaust to the condenser, the latter is of a form somewhat modified from the usual type built by the Alberger Condenser Co., although the fundamental counter-current principle is retained. Steam enters at the top of condenser, while condensation is drawn from the hot well at the bottom, being finally delivered to a hot water reservoir which receives other pure water returns. From this reservoir the boilers are partially supplied with feed water. Air is drawn from the condenser at about the middle of the shell, corresponding to the second of the three water passes. A branch from the exhaust connection communicates with a free exhaust through a suitable relief valve.

Circulating water for both types of condensers is drawn from a concrete cold well supplied by gravity from a nearby river, which has been dammed for this purpose. Motor-driven centrifugal pumps are used with both types of condensers, the motors being driven from the station bus. Entrained air is removed from the surface condensers by means of a duplicate set of rotative-type dry air pumps installed in a small addition to the power house, together with two large fire pumps which, in addition to the usual duties, are made use of while heating up the turbines preparatory to starting. For this purpose a small injection line is tapped into the water head of each condenser, and a supply of cold water drawn from the fire pump line for keeping the condenser cool until the turbine is ready to start. The main valve is then opened and circulating pumps are thrown in. Each condenser is served by a 10 in. Alberger centrifugal pump driven by a 30-h.p. type C motor. In freezing weather the power required for full load and high vacuum is, however, but little more than half the capacity of the motor, or about 1.17 per cent. of the power generated.

During normal operation the temperature of the discharge water is maintained at as nearly a definite degree as possible, as it is made use of in other parts of the plant. To accomplish this each pump discharge is throttled by a gate valve to such a degree as to yield the highest temperature of discharge water and still maintain the high vacuum. With 58° intake water and 108° discharge, a vacuum of 27 to 27¾ in. is readily obtainable at the elevation of Piedmont. This corresponds to above 28 in. vacuum referred to standard barometer (30 in.).

Boiler Plant.—Steam for power, evaporators, paper machines and other uses is furnished by a single boiler plant, aggregating 7,200 boiler horse-power. Each unit is of 600 h.p. capacity and of the Edgemoor water-tube type. All flues discharge into a single brick chimney. A unique feature of design is a Greene economizer installed on top of the setting of each boiler unit. Steam is supplied at a normal pressure of 150 lb. without superheat. It is delivered to the turbines without interposition of a separator.

Electrification.—In the Piedmont mill there are no less than 4,920 h.p. in polyphase motors, driving the various machines in small groups or in cases of large machines by independent drive; in the former by belts, in the latter by rawhide pinions. Motors vary in size from 1 to 400 h.p. Three of the latter size and three of 250 h.p. each are used to drive beaters. Six 100-h.p. motors drive paper machines, and smaller motors from 75 h.p. down perform similar service on calenders and other machinery. The majority are the standard Westinghouse type C motors. Several Westinghouse type F motors, however, are installed for special variable-speed drives. In one case, that of a 160-h.p. variable-speed drive, a double-coned pulley intermediate between the motor and paper machine gives delicate control of speed in addition to the seven different speeds of the motor. In the calender drive illustrated, a 15-h.p. type C motor gives constant slow speed, while a 75-h.p. type F motor with seven speeds provides the speed range necessary for accommodating different rates and grades of paper.



General Arrangement of Steam, Exhaust and Condenser Piping, West Virginia Pulp & Paper Company.

Operation.—During almost the entire period that the turbo-power system has been in service, the generating equipment has been loaded to its fullest capacity and even overloaded for long periods at a time in order to keep one unit in reserve for emergency. It has thus received an excellent service test extending over many months of continuous operation twenty-four hours a day. As an example, on June 5, 1905, the individual turbine load ranged from 1,000 to 1,220 kw. during the entire twenty-four hours as shown by the accompanying table. With a power factor ranging about 80 per cent., the temperature rise at the turbo-generator averaged 26.2° Cent. during the corresponding period. For a continuous overload of 25 per cent. the guaranteed temperature rise was 50° Cent. Both turbine units have carried 1,200 kw. each for 24 hours at a time with a temperature rise much below this, which illustrates the great reserve capacity of turbine type machinery. The heaviest load carried by the turbine units is unknown, as the wattmeters only read up to 1,600 kw. At times, however, it has largely exceeded this figure for short periods.

In spite of the size of many motors in use, the load on the station is extremely constant, except at times when the larger ones are being started. The maximum disturbance is caused when the 400-hp. type C motors driving beaters are thrown on the line. With the standard auto-starter the following observations were made from the switchboard meter: Frequency fell slightly below 25 cycles, load increased from 1,150 to 1,400 kw. Even with these changes, however, the effect of motor starting is comparatively negligible, as the disturbance is usually less than ten seconds in duration. The change in "note" of the turbine generator is scarcely noticeable, and the line voltage is quickly re-established.

Excerpts from Log for June 5, 1905, West Virginia Pulp & Paper Co.

Time.	Output, Kilowatts. Gentr. No. 3.	Exctr. Kilowatts.	Input. Per cent.	Steam Pressure.	Vacuum, Actual.	Temperature. Degrees Cent. Room.	Generator.	Rise.
7 A. M.	1000	15.24	1.52	Not recorded here.	27.75	19	45	26
12	1200	17.16	1.43		27.25	30	53	23
7 P. M.	1120	18.35	1.64		27.00	32	60	28
12	1140	17.68	1.55		27.00	27	55	28
7 A. M.	1220	17.68	1.45		27.00	32	58	26
Av. 24 hr.	1136	17.22	1.52	150	27.20	28	54.2	26.2

No. 4 turbine not running. No. 1 engine, 840-940 kw., average 890 kw. No. 2 engine, 880-940 kw., average 900 kw.

Generator temperature was measured by thermometer close to armature core. Guaranteed rise, with 25 per cent. continuous overload and 90-100 per cent. P. F., 50° C. for turbine units.

Power factor was measured by Westinghouse indicating meter on switchboard.

Steam pressure was recorded only on boiler room log; averaged 150 lb. in engine room.

Vacuum corrected for elevation of Piedmont, i. e., to 30 in. barometer, averaging above 28 in. Hg.

Condenser discharge temperature, 60°-70° F., average 67°.

It is of interest here that the load on the larger motors at starting is excessive; not simply due to friction of rest of the various bearings, shafts and belting which constitute the ordinary starting load of a motor, but, in this case, to a tremendous resistance encountered in the beaters, owing to the fact that the material temporarily "sets" around the agitators. As soon as the latter are well under way and the material has been broken up this resistance disappears. It is thus a noteworthy fact that, notwithstanding these sudden and excessive loads, the general operation of the power plant is scarcely affected. This is due to a considerable extent to the great overload capacity of the prime movers and the enormous inertia stored up in their revolving members.

Two operators are in charge of the generating room, the engineer and an assistant, who is also switchboard attendant. An interesting point in the operation of the turbines is that the oil used by the turbines is obtained at practically no cost, as it is later used up in the reciprocating machinery. A standard engine oil is employed for this purpose, and run through the turbines for a period of two or three weeks, then drawn off for the engines and replaced by fresh oil. As this oil is obtained at about half the cost of the highest grade turbine oils, considerable economy is effected in this often neglected item of power-house costs.

It is, unfortunately, impossible to obtain the water and coal consumption of the power station equipment, as such a large percentage of the steam generated is made use of at other parts of the works that only the crudest estimates could be made, and these would not give any adequate indication of the actual plant economy. The vastly increased efficiency of the new over the old power system is, however, continually attested by the multiplied production of the works. By this commercial and most effective standard all operation is gauged.

The success or failure of any power proposition in its entirety is determined by the final results secured. And, as the independent steam-driven system has so many points in its favor, it is particularly fortunate that the complete success of this electrical undertaking at Piedmont may be recorded, which is well summed up in the expressed opinion of the management, that "electricity proved to be the only means by which the production of the plant could be readily and sufficiently increased to keep pace with the demand for product."

The writer is very much indebted to the management through its vice-president and resident manager, Messrs. Luke, for much information concerning the operation of this plant and the facilities for its examination. To the West Virginia Pulp & Paper Co. is due much credit for taking so decisive a step as the complete electrification of its properties, which, through the able assistance of its consulting and designing engineer, Mr. Ten Broeck, has been carried to recent successful completion.

The Rhodesia Railways, Limited.—II.

Staff.—The line from Mafeking to Bulawayo is manned and worked by the Cape Government Railways, with executive headquarters at Mafeking, while the lines north of Bulawayo are similarly under the control of the Beira & Mashonaland Railways.

On the Vryburg-Bulawayo section the locomotive department is managed by a locomotive superintendent, under whose control is placed the care and upkeep of all engines, rolling stock, etc., together with the locomotive workshops, water pumping operations, etc.

The engineer's department is controlled by a resident engineer, assisted by two district engineers, and responsible for the maintenance of permanent way, works and buildings, and all matters pertaining thereto. Under each district engineer are placed three road inspectors, each having an average of 100 miles of track under his supervision. Plate layers or gangers are placed under the inspectors, and have a length 8 to 10 miles. The gang consists of one platelayer, one assistant and from six to eight natives.

Repairs to stations, buildings, bridges, etc., and new and additional works are carried out by a foreman-of-works and staff of artisans, also under the supervision of the district engineer.

Maintenance expenditure, embracing office expenses, supervision maintenance and renewals of permanent way, water supplies, repairs to stations, buildings, bridges, culverts, roads and signals cost £70 per open mile per annum on the Vryburg-Bulawayo section.

Traffic working is in the hands of a traffic manager; telegraph and postal work being also performed by the traffic staff at various of the smaller stations along the line.

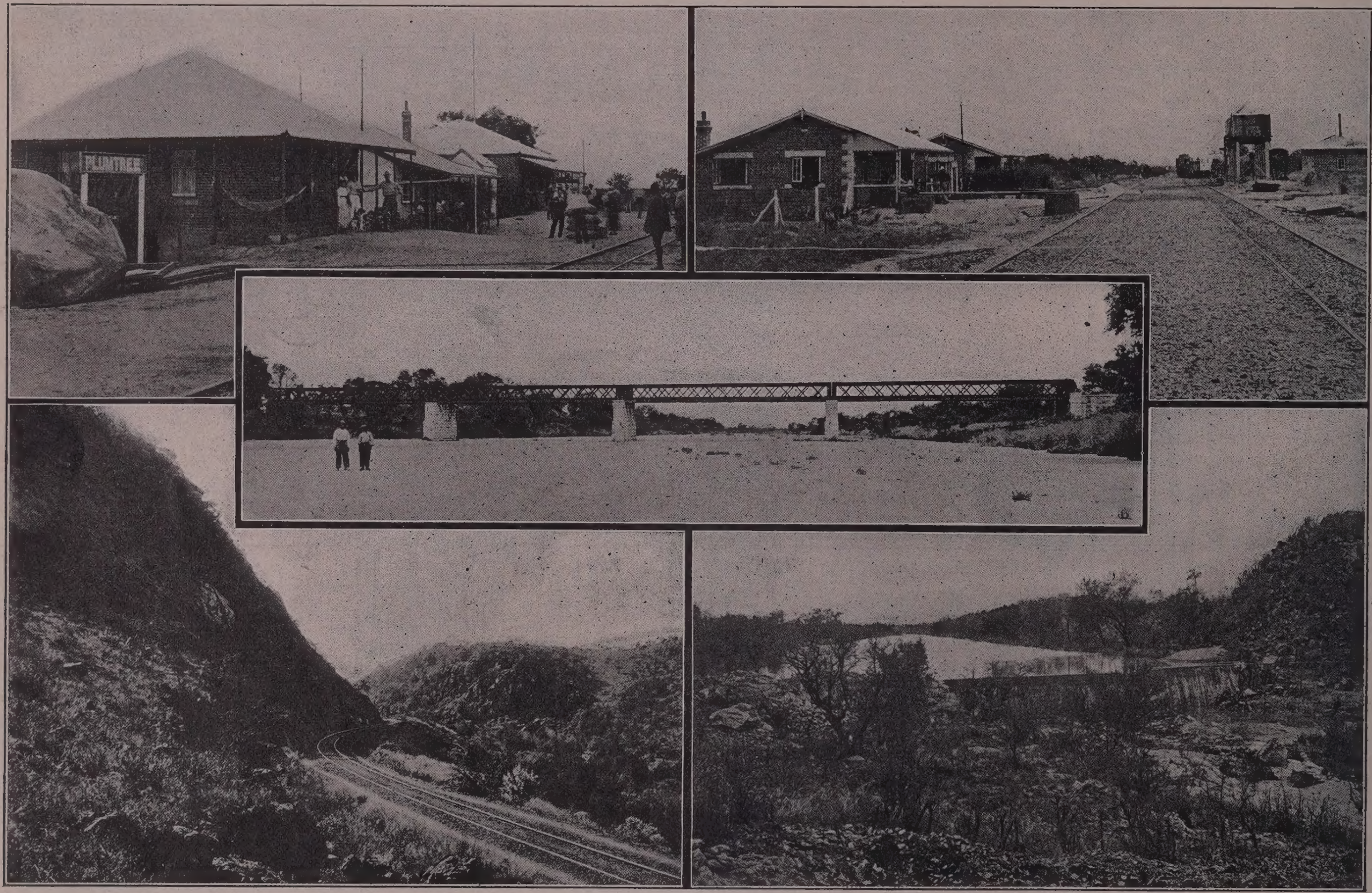
Sick Fund Board.—Medical attendance and comforts are dispensed to all employees free of charge, and to their wives and families upon contributing a small fixed sum monthly. Medical officers are stationed at Vryburg, Mafeking and Bulawayo, with appointed sections of the intervening line, who, in addition to the care of the employees at the points named, must travel over their appointed sections at least once a week to attend the railway staff resident along the line. The Sick Fund Board further provides for partial payment of: (a) Employees' wages during sickness or disablement owing to accident sustained on duty; (b) hospital expenses; (c) burial expenses.

Provision Train.—The difficulty of providing employees at roadside places with food and other necessaries was overcome by the establishment of a provision train, running once a month, and bringing supplies to employees' order from the nearest coast town at fixed contract prices.

Pension Fund.—Officers and employees are granted the privilege, on entering the service, of becoming contributors to the Cape of Good Hope Civil Service Pension Fund, should they elect to do so, in compliance with the established conditions, and the opportunity is availed of to a large extent.

Labor.—All unskilled labor, connected with platelaying and excavating, as well as coaling, portering and the like, is performed by natives, generally in small gangs, under the control of one white man. These natives, of whom, in normal times, there is a plentiful supply, are paid at a uniform rate of 2s. per diem, and are well adapted for this class of work. The ratio of white to native employees averages about one to four.

Artisans and skilled laborers are principally Europeans, while the technical and clerical staff



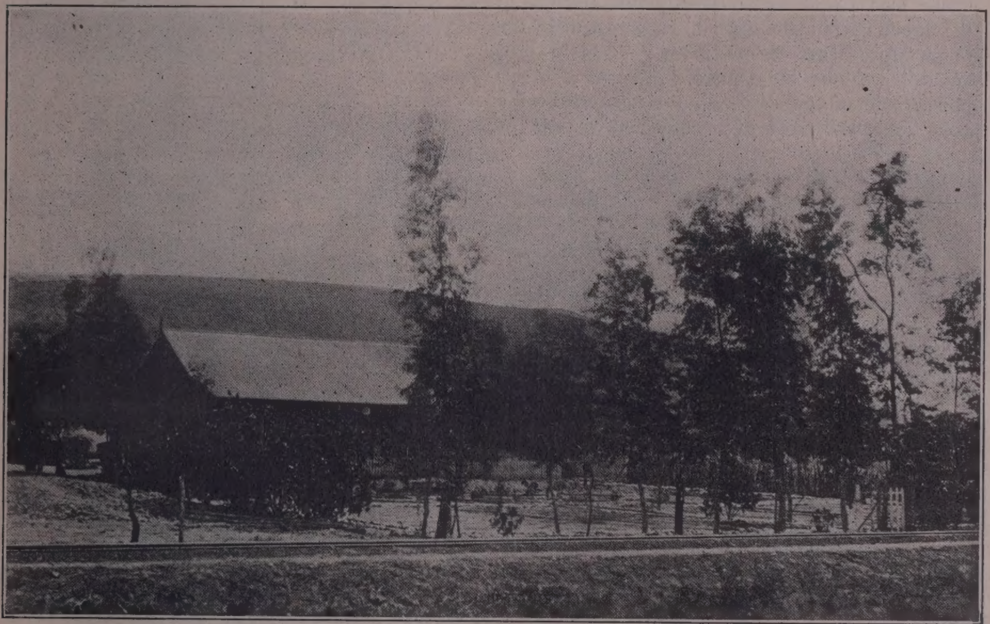
Typical Roadside Station, the Tati River Bridge, the Lobatsi Gorge, and a Railway Reservoir.

has been to a large extent recruited from British railways.

Traffic.—The traffic going north consists of general merchandise, machinery, cut timber, livestock and imported grain and other goods. Traffic from the north is principally coal, rough wood for fuel and pit timbers, hides, mealies and other Rhodesia-grown produce. Large batches of natives proceeding from and to the gold and diamond mines and other labor centers pass frequently, and are conveyed at reduced rates in specially fitted trucks.

On the Vryburg-Bulawayo section there are four regular trains per week each way, viz.: One passenger (Zambesi train-de-luxe), two mixed and one freight. Additional freight trains run as often as required.

Description of Route.—Presuming the traveler to have arrived at Cape Town, or one of the other seaboard towns, a daily train composed of comfortable corridor saloon cars, with sleeping and lavatory accommodations, will convey him to Kimberley without change, while on three days a week the entire journey from Cape Town to Bulawayo may be made in through cars of first or second class. A train-de-luxe, the Zambesi Express, runs between Cape Town and Bulawayo weekly in each direction, conveying mails and passengers, and so timed as to afford connection with the Royal Mail steamers of the Union-Castle line.



Type of Cottage for Track Gangs.

Leaving Kimberley, the heart of the diamond mining industry, the railway is carried over the Vaal River, near Fourteen Streams station, by a bridge 1,354 ft. long between abutments, consisting of ten spans of 130 ft. in the clear. Each span consists of two parallel wrought iron lattice girders, 135 ft. 9 in. long, by 14 ft. 4½ in. deep and 2 ft. 6 in. wide over flanges, placed 15 ft. 6 in. apart, center to center, supported on iron work cylinder piers, the main girders being connected at their bases by cross girders to form the road bed, while each pair of main girders is also connected overhead by four arched girders. This massive structure was blown up in the early stages of the Anglo-Boer war and was rebuilt in 1901.

From the Vaal River the line ascends to the high plateau of Bechuanaland, which it traverses at an average altitude of 4,000 ft. above sea level to Mafeking. Long tangents and easy grades rule, and no large bridges were necessary. The formation is sandy, with granite underlying. Grass grows rapidly and abundantly, trees are sparsely dotted over the boundless veldt, which forms an ideal cattle raising country, and is populated principally by aboriginal natives. The ruling gradient on this section of the line is 1¼ per cent., uncompensated for curvature, of which latter the maximum is 6 deg.

At Mafeking, of Anglo-Boer war fame, are situated the locomotive workshops and executive headquarters of the running staff; the railway settlement, consisting of 100 dwellings for married employees and barracks for single men, forming a neat little village. Double rows of trees line the avenues, each cottage has a well stocked garden, a plentiful supply of water exists, and a nursery for rearing fruit and shade trees has a large annual output to the numerous stations and settlements along the line for 600 miles.

The recreation of the employees has not been overlooked, and a commodious "institute," comprising theater, billiard room, reading room, library, etc., is not the least important feature of the little village.

The town of Mafeking is situated to the east of the railway, and is a large trading center, being the nearest point of railway communication to the western Transvaal. A branch line to open up the district named is at present in course of construction, starting from Mafeking, entering the Transvaal at Buurman's Drift (to which point it was opened for traffic on Oct. 1, 1904), and thence by way of Ottoshoop to Krugersdorp and Johannesburg.

Continuing the journey toward the Victoria Falls, the line passes from Cape Colony into the Bechuanaland Protectorate at a point 16 miles north of Mafeking. The country now becomes more hilly and more thickly wooded, and after a few stiff climbs, drops away from 4,400 ft. to nearly 3,000 ft., continuing at this altitude for some 300 miles. These lower levels of the protectorate are sparsely populated, thickly wooded and sandy; water is very difficult to obtain, the established supplies being a long distance apart and frequently failing entirely. The principal waterways are the Mahalapye, Lotsani, Maclousti, Shashi and Tati rivers, dry for the major portion of the year, but running very strong during the summer rainy season.

Near Plumtree and 419 miles north of Mafeking, the line enters Southern Rhodesia, and ascends tortuously to the higher altitude of 4,400 ft., at which Bulawayo is situated. On this section are more small bridges and culverts and a greater percentage of curves than hitherto encountered. The ruling gradient is 1¼ per cent., with 4-deg. curves. The country here is picturesque, green and well-wooded, the Matopos Hills, famous in war and as the last resting place of the founder of Rhodesia, being visible from the train.

The territory traversed by the railway between Mafeking and Bulawayo forms the homes of many native tribes, and their primitive huts and habits of life may often be studied from the train. They dress grotesquely, own large herds of cattle, and exist on maize, sorghum and millet, which grow well in the valleys. The only white settlement of any size is at Francistown, 364 miles north of Mafeking, where a mining and trading industry is carried on, and the headquarters of the Government of the Northern Protectorate situated.

At Westacre Junction, 17 miles south of Bulawayo, a small branch line has been laid, nine miles in length, and within easy distance of the "World's View," the last resting place of the mortal remains of Cecil John Rhodes.

The Cape Line enters Bulawayo from the west, and here the journey to the Zambesi may be broken or continued at will, there being a connecting train in waiting, while the town of Bulawayo with its fine buildings and palatial hotels affords every convenience for a brief or prolonged stay, combined with excursions to the Matopos Hills and many points of interest in its vicinity. Being situated at an altitude of 4,400 ft. the climate of Bulawayo is bracing and equable.

Bulawayo is fast becoming one of the most important railway towns of the African Continent, and, from its central position, lends itself as the future headquarters of the Rhodesia Railways Administration. It forms the junction of the lines from Cape Town, etc., and the Matopos branch, which enter from the west, of the main line from Beira and Salisbury and the Gwanda and Selukwe branches, which enter from the southeast, with the Zambesi line which lies in a northwesterly direction.

Leaving Bulawayo by the last line the profile of the country falls steadily to the Gwaai River, 89 miles from and 1,200 ft. lower than Bulawayo. From the Gwaai the line traverses more of the flat, sandy and thickly wooded country, and here the line is perfectly straight for 71 miles. From the end of this piece of straight road to the Wankie Coalfield, the line continues to fall between hills and through thick bush, until the low altitude of 2,400 ft. is reached. Over this section 4-deg, curves and 1¼ per cent. gradients rule, but it was only on the last 50 miles that heavy cuttings and embankments were unavoidable.

Leaving Wankie the journey to the Zambesi is continued over 6-deg. curves and 2 per cent. gradients until the watershed of the Zambesi, some 12 or 13 miles from the river, is reached, and at this distance a great column of spray is distinctly visible. The railway station and commodious hotel are situated 282 miles from Bulawayo, and just to the south of the Falls. The magnificent and impressive sight of the vast volume of water falling precipitously 400 ft. is one which cannot fail to gain the traveler's admiration and awe. Just below this great cataract the gorge is spanned by a graceful bridge, 650 ft. long, with two short approaches and one main span of 500 ft., at a height of 480 ft. from the surface of the river, and adding considerably to the attractiveness of the scene. The handiwork of nature and man is blended in a manner almost unique, and from this great triumph of engineering art and constructive ability a magnificent view of the 50,000,000 "horse-power-unharnessed" is afforded.

From the river the railway rises and gradually disappears into the vast and unknown regions of Equatorial Africa.

In the brief space of ten years Rhodesia has passed from the rule of a savage king and from a country where railways were unknown, to one of premier importance, with a mileage of railways greater than the Natal, Transvaal or Orange River Colonies; thanks in a great measure to the genius of the departed statesman and to the broad-minded policy of the engineers upon whom devolved the detail of so unique an enterprise. The line once laid, the standard of the roadbed, buildings and equipments have been improved upon as traffic developed, and the line to-day is in as high a state of efficiency and capability as those of the neighboring colonies.

The whole of the Vryburg-Zambesi construction was carried out under the direct supervision of Mr. S. F. Townsend, chief resident engineer of the Rhodesia Railways.

The Third Rail of the New York Central R.R.

The accompanying illustrations show the general features of the type of third rail which originated with Mr. W. J. Wilgus, vice-president of the New York Central, and Mr. F. J. Sprague, of the Electric Traction Commission of the company. This design gives a third-rail location of 29 in., which is 1½ in. farther from the gauge line than that of the Long Island R. R. standard, but this difference is not enough to preclude an interchange of equipment with a suitable shoe which can be arranged to pass automatically from under contact to top contact and vice versa.

This type of construction is estimated to cost somewhat less per mile than a protected top-contact system, and to be considerably less expensive to maintain. Experience with the type has disclosed no breakages whatever in the clay insulators employed on the test track.

The exact type of insulator for the New York Central work has not yet been definitely adopted. The board protection has a continuous support upon the rail so that it cannot crack and warp, and the rail is shielded from sleet; in this connection it should be noticed that the bottom of the rail is unusually well elevated above the ground so that snow, ice and rubbish are not likely to reach it. The construction of this type is such as to require a constant wide space between the live third rail and the ground, whereas in top-contact designs the accumulation of rubbish, snow and ice may continue without disturbance, thereby increasing the chances for leakage of current.

The principal factor to be considered in the design of the third rail is that of safety, because not only from humanitarian motives is it desirable to employ the least dangerous third rail system that can be designed, but also from the selfish standpoint that a company must look forward to possible demands by public authorities for the adoption of a third rail that will be more safe than the usual top-contact device. A man stumbling or falling so as to come in contact with the third rail is likely to touch the live portion of any top-contact system. The New York Central design overcomes these objections and makes it very difficult for anybody to touch the rail unless he deliberately tries to do so.

In accomplishing these ends it should also be noticed that the design is of an attractive appearance, which should by no means be overlooked.

Beveled Rail Joints are used by the Consolidated Railway Co. of Denver. The plane of the level is at right angles to the web and forms an angle of 78 deg. with the rail base.

Ozone for Water Purification.

The use of ozone in water purification is gradually becoming a subject of some interest in the United States, although it has by no means received the attention here that has been given it in Europe. Up to the present, indeed, it has mainly been studied by manufacturers of electrical apparatus, although ozone is not necessarily produced electrically. For example, Moissan prepares the gas by the action of fluorine on water, and others have utilized phosphorus. The most promising methods, however, are all electrical, and an account of them, contributed to the "Electrical World and Engineer," by Dr. Arthur W. Ewell, technical adviser of the only company in America engaged in water purification by ozone, gives in condensed form a good idea of the progress of the method to the present time.

The electrolytic method has been carefully studied by Targetti and Grafenberg. Grafenberg found that sulphuric acid was the best electrolyte and Targetti that the best strength was 22° Baumé (or specific gravity 1.18). Any change in the nature of the cathode was found to be of little importance, but lead proved the most efficient material for the anode, and the production of ozone was found to be directly proportional to the anode current density and independent of the temperature when below 17° C. With a lead anode 1 cm. long and 0.5 mm. in diameter, in sulphuric acid of the above dilution, an e.m.f. of 7 volts gave a current of 2 amp. and 5.4 mg. of ozone were produced at the anode per hour. This is equivalent to 2.73 grams of ozone per hp.-hour, which is far inferior to the results obtainable with other methods.

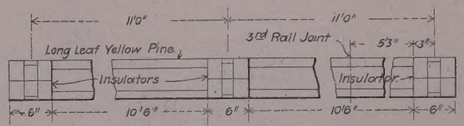
The direct electrical methods may be subdivided in two ways. First, as regards electrodes. The electrodes may be plates, wires or points or complex combinations. Secondly, they may be classified according to the method for preventing sparking and arcing, an obvious difficulty, since several thousand volts are required to force a suitable current through a gas.

The simplest apparatus is that of Tindal, which consists of two parallel metal surfaces connected to the poles of a 50,000-volt transformer. A current of air flows between several such pairs of plates and the electric current flowing from one plate to the other, through this air, partially transforms the oxygen into ozone. The efficiency is low, however, the yield being 3 to 4 grams of ozone per kw.-hour, and this method is not in use at the present time.

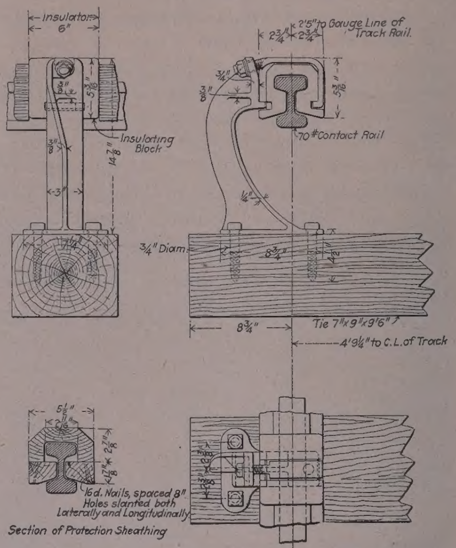
An apparatus with wire gauze instead of the plates has been developed by Rosenberg and an output of 250 grams per kw.-hour is claimed, but as the air was not dried before entering the apparatus considerable nitrous oxide might have formed and been mistaken for ozone.

The Siemens & Halske apparatus differs from the Tindal in that one of the plates is covered with glass or mica, and the other plate is grounded and cooled by water. The plates, cylindrical or plane, have an area of several square yards. A difference of potential of from 8,000 to 15,000 volts is used. The apparatus is claimed to give an output of between 20 and 30 grams of ozone per hp.-hour, with an ozone concentration of 2 grams per cubic meter of air.

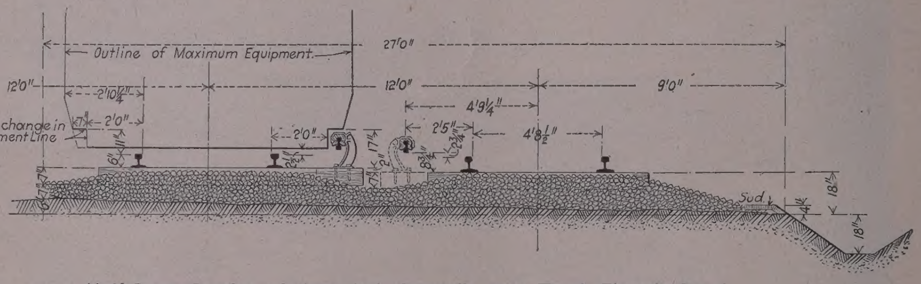
The Elworthy apparatus is similar to the Siemens & Halske except that both (cylindrical, concentric) electrodes are covered with glass and the air passes over each in succession. An output of from 60 to 70 grams per kw.-hour is claimed, but the figures are doubtful, since the air was not dried.



Protection Boards.



Supports for Third Rail.



Half-Cross Section of New York Central's Four Track Electric Road.

The Marmier-Abraham ozonizer has parallel, glass-covered, water-cooled electrodes, one meter square, at a difference of potential of 40,000 volts (alternating current). Air dried with pumice and sulphuric acid flows between the plates and 20 grams of ozone are said to be produced per hp.-hour.

In the Otto ozonizer one electrode consists of revolving beveled-edge discs. For half a revolution they are about an inch from an outer electrode and for the remainder the outer electrode is farther away and covered with glass. This increase in distance, together with the glass and the removal of two sectors of the discs, prevents arcing. A potential of 25,000 volts is used.

In the Vosmaer ozonizer one electrode is plane and grounded. The other carries a great number of points. A difference of potential of 10,000 volts (alternating current) is used and an output of 15 grams of ozone per kw.-hour is obtained with an ozone density of 3 grams per cubic meter. The air, previously dried with chloride of calcium, flows between the points and plate and the electric current (a small fraction of an ampere) partially ozonizes the oxygen.

An ozonizer must guard against sparking and arcing. The ozone is produced by a quiet electric current through the air. A spark, however, decomposes the ozone, and an arc destroys the apparatus. In the Siemens ozonizer glass plates are interposed between the electrodes. This necessitates a higher potential and an annoyance from breakage of the glass. The Marmier-Abraham apparatus uses an external spark-gap, the Otto a revolving electrode and the Tindal an external choking coil. Vosmaer uses the choking coil together with a condenser in shunt with the ozonier and succeeds in obviating both sparking and arcing.

The Otto apparatus is used in France in the manufacture of organic products and has recently been installed in an experimental water purification plant at Niagara Falls.

The Marmier-Abraham ozonizer is in use in a brewery at Marseilles and at Lille in a water purification plant, which has been in operation since 1898, and which has been taken over by the city. The capacity of the plant is nearly a million gallons a day and the cost of purification is about $10 per million gallons.

The earliest Siemens & Halske water purification plant was erected at the company's works at Martinikenfelde, near Berlin, to supply purified Spree water for a population of about 5,000. The water trickles through a tower filled with stones five meters high and one meter in diameter, while the ozonized air enters at the bottom and rises. Analyses by Dr. Erlwein of the water before and after purification for a period of several days gave (per c.c.): Bacteria before purification—maximum, 200,000; minimum, 2,300; average, 80,000. Bacteria after purification—maximum 34; minimum, 0; average, 8. There was an increase of 12 per cent. in air and 38 per cent. in oxygen. All pathogenic germs were destroyed.

A similar plant was erected at Wiesbaden (Schierstein a Rh.), but given up on account of a troublesome precipitate which the ozone formed with iron present in the water. Another Siemens & Halske plant has been in successful operation at Paderborn since August, 1902, supplying all the water for the town (about half a million gallons a day). About 1.3 grams of ozone are used per cubic meter of water and the total cost (interest and depreciation included) is about $15 per million gallons. Dr. Erlwein estimates that for a similar plant with a capacity of 10,000,000 gallons a day the total cost would be but $7 per million gallons.

The Vosmaer system has been in use at Nieuwersleuis, Schiedam and Rotterdam, Holland, and at Philadelphia. The crude water passes through a rough sand filter to remove suspended matter and enters the top of a tower about 30 ft. high; the ozonized air, forced through small holes in the bottom, rises in very small bubbles and comes into contact with all the water. Special openings are provided for the outflow of the water at the bottom and the escape of the air at the top. Sufficient ozone is supplied to have a small excess in the escaping air. This system uses from one to five grams of ozone per cubic meter of water, depending on its condition, and the cost of operation is from $3 to $7 per million gallons of water. Dr. H. J. van't Hoff found that the bacteria were reduced from 200-20,000 per c.c. to 1. Color and taste were removed from the water. Any residual ozone quickly decomposed. The amount of oxidizable matter in the water was greatly reduced. In brief, this purification appeared to remove practically everything except industrial contamination. The reliability of the apparatus has been illustrated at the Schiedam plant, which was in continuous operation with no interruption, eleven hours a day, for two periods of six months each. The Philadelphia plant is in the heart of the city and successfully purifies a million gallons a day of the very polluted Schuylkill River water. It is owned by the United Water Improvement Company, which holds the American patents of Vosmaer and Lebret. One of the towers is of glass and the process of purification may be clearly seen. Dr. Rivas, of the Water Department of Philadelphia, has recently made a careful test of this plant. He found that the number of bacteria was reduced from about 1,500,000 per c.c. to 38-55, when 10,000 gallons were being purified per hour, and that these remaining bacteria were all harmless, disease germs being totally destroyed. This selective action of ozone Dr. Ewell considers very interesting and important.

Sewage Disposal in Ohio, Wisconsin and Illinois.

In the last half dozen years or so a considerable number of sewage disposal plants of various types have been built in Ohio, Wisconsin and Illinois, most of which have already been described in this journal. Last winter they were visited by Mr. C.-E. A. Winslow, who obtained much interesting information concerning their operation. This he has embodied in a voluminous paper before the Boston Society of Civil Engineers, which has just been published in the "Journal" of the Association of Engineering Societies. One important feature brought out early in the paper is that intermittent filtration, so useful in New England, is inadequate over most of the Middle West on account of lack of suitable land. The experience at Oberlin, O., a place of 5,000 population, Mr. Winslow considers fairly typical.

The first sewers were constructed in 1892 and two years later a field in the outskirts of the town was laid out for sewage disposal. Six acres of fine sandy loam were available to receive gravity flow, of which three acres and a half were underdrained for intermittent filtration and an acre and three-quarters merely ditched for broad irrigation. Two settling basins, 3 ft. deep and 10 ft. by 30 ft. in area, were constructed by excavating pits and boarding up the sides, and from these the sewage overflowed through distributing ditches on the beds. Sludge from the pits was pumped out and dumped near by; it amounted to some 4 per cent. of the sewage treated. For some years the plant worked well while the average flow of sewage remained below 100,000 gallons per day. Since 1902, however, it has rapidly increased, to some 250,000 gal. at the present time, and the beds have become heavily overtaxed. In order to prevent serious pollution of the creek below, the system has been converted into a sort of chemical precipitation plant by a process probably unique in the history of sewage purification. During the warmer nine months of the year chemicals are discharged into the main sewer of the town, about 125 lb. of ferrous sulphate and 150 lb. of lime in the form of hydrate, by automatic devices located respectively at the upper end and the middle of the system; sedimentation takes place in the pits and on the beds which are generally clogged and a considerable nuisance is created. When Mr. Winslow visited the works in January no chemicals were being used and the sewage was simply standing on the beds and overflowing into the creek, turning the whole area into a noxious swamp.

In general, of course, the septic tank treatment is only used in these States, Mr. Winslow found, as a preliminary to intermittent or contact filtration, and on these principles many admirable plants have been constructed and are in operation in the Middle West. Of the first type he mentions three good examples, one at Lake Forest, Ill., and two at Wauwatosa, Wis. The Lake Forest plant was designed in 1902 by J. W. Alvord and W. S. Shields to care for a flow of 350,000 gal. a day. A population of 1,800 at that time has now increased to about 3,000, and it is probable that the plant is nearing its full capacity. It is beautifully located at the bottom of a bluff on the shore of Lake Michigan. The sewage first flows through an open brick septic tank protected from abrupt temperature changes by a light brick structure and divided into five compartments so arranged that by various combinations the period of septic action may be adjusted to suit varying conditions. It is, unfortunately, almost impossible to secure proper expert supervision of sewage disposal under present conditions, and at all the plants which Mr. Winslow visited the operation of the "elastic tank" had been practically abandoned and the whole available area was used as a single tank.

At Lake Forest with a tank 35 ft. by 20 ft. in area and 8 ft. deep, and a capacity of 50,000 gal., this method of operation gave a period af about four hours. One-third of the tank back of the first baffles was covered with a very heavy layer of frozen scum, while the rest of the tank showed only half an inch of light scum. The effluent from the tank, which runs over an aerating weir into a dosing chamber of 7,000 gal. capacity, appeared to be a good septic sewage, dark colored and with only very fine suspended particles. The tank has never been cleaned out.

One important feature of the western sewage plants is the general attempt to introduce automatic devices for regulating flow and for dosing filter beds. The danger from the failure of such devices is, of course, always considerable and they absolutely require periodic expert supervision; but Mr. Winslow is inclined to think even a fair automatic device will prove as reliable as the average city employee. The apparatus used at Lake Forest for dosing the sand filters is an extremely ingenious one. A float in the dosing chambers lifts a cannon ball in one of a set of hollow wooden columns arranged in series, and at a certain height the ball rolls through a trough from one column to the next, in its passage striking a catch which opens an air valve attached to one of ten bell syphons in the dosing chamber. Each syphon discharges on one of the ten sand filters which may thus be dosed in rotation. At the time of Mr. Winslow's visit the automatic device had been purposely thrown out of gear so that the sewage was flowing continuously upon one bed, perhaps with the idea of preventing the surface from freezing.

The sand filters are each 3,200 sq. ft. in area, the total area being three-fourths of an acre and the rate is therefore now over 400,000 gal. per acre per day. The filtering material, the natural beach sand of Lake Michigan, is quite fine, 85 per cent. passing a sieve with 40 meshes to the inch, and 42 per cent. passing a sieve with 60 meshes to the inch. With the dosing device deliberately thrown out of operation the Lake Forest plant was not doing wholly satisfactory work. Sewage was standing several inches deep on the one bed which could receive it, and the effluent as it flowed off to the lake was dark colored and appeared imperfectly purified.

A plant very similar to that at Lake Forest was built four years ago by Alvord and Shields for the town of Wauwatosa, Wis. The population of the town is about 3,000, but there are not more than 200 connections with the sewer system, including a sanatorium, a pickle factory and a chemical works. The flow is said to be about 100,000 gal. a day. The sewage first enters a concrete septic tank sheltered as at Lake Forest by a brick roof. The tank is approximately 15 ft. by 50 ft. by 10 ft. deep with a capacity of 40,000 gal. It was originally provided with three longitudinal partitions but the sewage is now run straight through, giving a storage period of 10 hr. At the time of Mr. Winslow's visit the first tenth of the tank behind the first baffle bore 6 to 8 in. of very heavy scum, and a considerable accumulation of sediment could be felt at the bottom. The town engineer informed him that the tank must be cleaned out twice a year, a quantity of combined scum and sludge equal to half its capacity being removed by dipping out with pails and by the use of a small rotary pump. The effluent appeared like a good septic sewage, dark gray in color and with no large particles.

The septic effluent should pass to a dosing chamber in a separate small brick structure where it may be discharged on sand beds by the same device in use at Lake Forest. The beds are 6 in number, 30 ft. by 60 ft., with a combined area of one-fourth acre, thus giving a rate of 400,000 gal. The sand used is coarse and the results obtained are said to be excellent. In cold weather, however, it is the practice of the authorities to discharge the septic effluent directly into Menominee Creek without filtration. This has not been compelled by any failure of the plant, but is done to avoid the expense of caring for the surface of the beds during a season when the septic tank effluent will not produce a serious nuisance in the river below.

In the same town is a larger plant of almost exactly similar construction, built by W. S. Shields, in 1904, which shows what good results can be obtained by careful and efficient operation. The Wauwatosa County Institutions form a group of five buildings, including two insane hospitals, an almshouse, a county hospital and a home for dependent children. The total population is about 3,500 and the water consumption, 400,000 gal. per day. A chemical precipitation system was put in in 1888, the dosing house and coagulating basin still remaining as its monument. Then a septic tank alone was installed; but it proved unsatisfactory, and about a year ago Mr. Shields built a new septic tank and filter beds. It is planned to use the old tank as a part of the septic system in the future, but at the time of Mr. Winslow's visit the sewage was flowing only through the newer one. This is 85 ft. long, 20 ft. wide and 8 ft. deep, with a central longitudinal partition and 3 concrete baffles. The first two compartments, making up about a third of the tank, bore a thick frozen scum raised by gas pressure 6 in. above the surface of the liquid. At the outlet as it ran off over an ærating weir, the effluent appeared a strong septic sewage still containing a fair amount of suspended matter. The storage period under present conditions appears to be 6 hr. With the addition of the old septic tank, 8 ft. by 17 ft. by 54 ft., it would be increased to 9 hr. Both tanks are of concrete, housed under low brick buildings with gabled roofs.

From the septic tank the sewage flows through an inverted syphon to the filter beds which are located on the further side of a small stream. The beds are eight in number, arranged in two rows with a controlling house in the center. The four corner beds are each 50 ft. by 110 ft., while the four center beds are 57.3 ft. by 55 ft., being shortened to provide room for the distribution system. The latter is of the general pattern described above, including a dosing chamber discharged by any one of eight 15-in. syphons, each connected with one bed. The rotation of the beds is controlled automatically by a cannon ball device quite similar to that used at Lake Forest.

The filter beds are built up of 12 in. of coarse gravel, 12 in. of fine gravel and 12 in. of coarse sand, and are underdrained by four lines of 4-in. pipe. The carriers are of the usual type, two straight troughs in each bed with 3-in. square holes about 2 ft. apart.

The plant is carefully supervised by the superintendent of the institution, and was working in admirable shape when Mr. Winslow saw it. The syphons flush perhaps once every 35 min. in the morning, every 45 min. in the afternoon, and once an hour at night, so that each bed is dosed once in from 4 to 8 hrs. The total area is about 1 acre for the 400,000 gal. treated. In spite of severe weather in January the dose disappeared in twenty minutes after its application; but at intervals it is necessary to rest a bed for a few days by putting into the cannon ball regulator a chute which shall shut out one of the dosing syphons. The effluent flowing from the plant into the Menominee Creek was clear and well purified.

It is only rarely that such plants as those at Wauwatosa can be installed in the West, for the use of larger communities, since, even after preliminary septic treatment, the requisite sand area is generally unobtainable. Hence, the newer English types of filters have been frequently adopted; and the septic tank and contact filter is the most popular of all combinations through Ohio and Iowa. A dozen systems of this type are installed in these states, with an aggregate contributing population of 60,000. Mansfield, O., (20,000); Marshalltown, Ia., (11,000); Delaware, O., and Kenton, O., (each 8,000); are the largest cities in this class.

The disposal system at Mansfield, built by Snow and Barbour, three years ago, is one of the most perfect of this type as well as the largest. The town is a thriving farming and manufacturing center with a population of 20,000. About half the inhabitants contribute sewage, the total amounting to 1,000,000 gal. per day. The purification works, about three-fourths mile from the center of the city, and with dwellings not an eighth of a mile away, are very neat, from their well-kept driveways and embankments to the spotless engine room with a row of potted plants in the window. The sewage flows by gravity to a sludge well from which it is raised by two 7-in. centrifugal pumps to the septic tanks. Both tanks and sludge well are ventilated by connection with the stack from a Dixon crematory in the pumping station which handles the city garbage, amounting to 15 to 20 tons a day.

The septic tank is an arched concrete chamber covered by an artificial mound, its presence being indicated only by the manhole covers. It is built in four compartments, each 50 ft. by 100 ft. and 7 ft. deep with a total capacity for the four of 1,000,000 gal. The sewage flows now through all in parallel, the period of septic action being twenty-four hours. In the three years of their operation these tanks have never been cleaned and the superintendent stated that not more than 1 in. of sediment and 2 in. of light scum have ever formed. Comparison with some of the tanks described above suggest to Mr. Winslow that perhaps the longer period of septic action has had some share in these excellent results.

From the septic tanks the sewage flows over a series of aërating steps, and thence to the regulator house situated in the center of a circular group of five contact beds. The automatic dosing device consists of two concentric iron cylinders about 2 ft. in diameter, the outer one stationary and pierced by five ports, one for each bed, the inner one revolving so as to bring its single influent port successively opposite each of these five points of discharge. A float, regulated by the height of sewage in whichever bed is filling, at a certain height starts the inner cylinder, closes the outlet from the bed next to be filled and opens the outlet of the bed which has stood full since the last revolution. Each of the beds has an area of one-fourth acre and is filled with one-eighth in. to one-half in. cinders to a depth of 5 ft. The period of contact is about 4½ hr. and the rate of treatment 800,000 gal. per acre per day.

At the time of Mr. Winslow's visit the beds had been out of use for two or three days during the process of cleaning out part of the low level sewer system, as it was feared the silt might damage them. The septic effluent was going straight to the nearby stream. The superintendent stated that this had occurred only once or twice before during the operation of the plant. The surface of the beds seemed in admirable condition and the effluent of the plant is generally excellent.

A small contact system is installed at the Lake Shore & Michigan Southern R. R. car shops in the thickly settled portion of the village of Collingwood. The sewage of 500 operatives flows to a pump well from which it is automatically raised at intervals by a pump driven by compressed air and discharged into two septic tanks, each 21 ft. by 10 ft. by 9 ft. deep, with a capacity of 25,000 gal. When the sewage in the septic tanks reaches a height of 8 ft. they are supposed automatically to discharge the upper 2.5 into four contact beds, concrete basins, each 15 ft. by 29 ft., filled with 5 ft. of 2-in. limestone. On filling, the beds discharge through syphons. The plant is a neat and compact structure with brick walls and plank covering and is supposed to operate entirely without supervision. At the time of Mr. Winslow's visit all the automatic devices were frozen, the pump was not working, the septic tank contained a thin but foul stagnant liquor and the sewage was apparently flowing off through a by-pass. He believes this must infallibly prove the fate of automatic devices if their automaticity is construed literally and they are left entirely without supervision.

The largest trickling filter is the one which handles the sewage of the 20,000 people of Madison. Mr. Winslow did not see this, but found a smaller plant installed at the car-shops of the Allis-Chalmers Co., at West Allis, just out of Milwaukee. This plant, designed by Mr. Shields in 1902 to care for 80,000 gal. of sewage per day from the large factory in which 3,500 men are employed, is located on a hillside behind the works and consists of a concrete septic tank and anaërobic filter covered with a gabled roof and a trickling filter under a second roof and at a lower level. The open septic tank is divided by a central partition into two long tanks, each 10 ft. by 58 ft. and 7.5 ft. deep, the total capacity being 65,000 gal. or 18 hr. flow. Below the tank the sewage is aërated by fall over a weir and some steps and then enters the anaërobic filter, so called, which is practically a second septic tank, 21 ft. by 33 ft. long and 7.5 ft. deep, filled with clinker and cinders in graded layers. After flowing upward through this tank the sewage passes to three 3 ft. by 5 ft. syphon chambers which discharge it on the trickling filter below. This filter is practically a pile of cinders and clinker, varying from 0.25 in. to 0.75 in. in diameter held together by larger clinkers on the outside, piled with a slight batter. The height of the heap is 7.5 ft. to 8 ft., its superficial area, 30 ft. by 54 ft., and the concrete floor upon which it rests is 40 ft. by 60 ft. Considerable trouble has been experienced from disintegration of the clinkers. In winter the sides of the filter were closed in by plank walls; but in warm weather the whole is open. The distribution system is very simple, consisting of three 12-in. plank troughs with 4-in. lateral troughs in the bottom of which 0.25 in. slits are cut at a distance of 8 in. apart. Each syphon discharge floods one main trough with its laterals, and the distribution as I saw it appeared satisfactory.

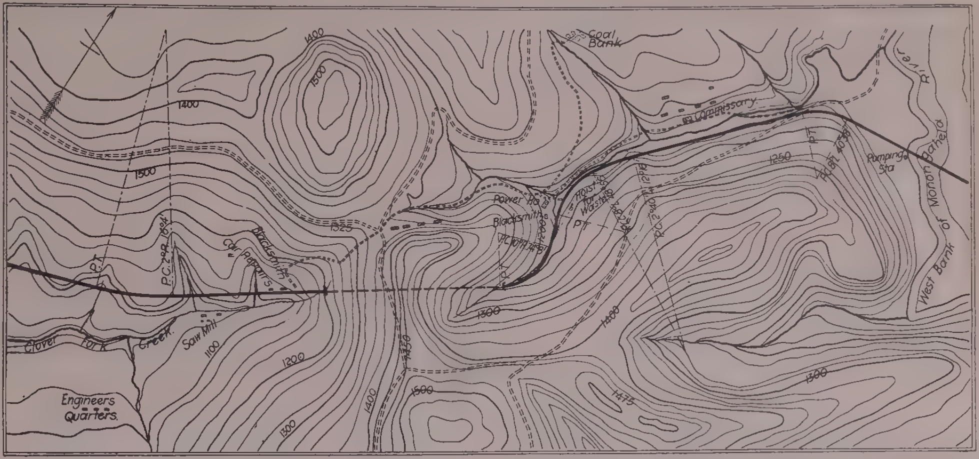
Mr. Shields states that the actual flow of sewage at the plant has been much greater than that for which it was designed, reaching a rate of over 300,000 gal. per 24 hr. for 12 hr. of the day. No trouble has been experienced from freezing, and the trickling filter has been operated at a rate of over 3,000,000 gal. per acre per day, yielding a bright and odorless effluent. It appeared evident, however, on Mr. Winslow's visit that the applied sewage is of unusual character, being mainly clear wash water from boilers and manufacturing processes with fragments of fecal matter floating in it only here and there. Furtheremore, its temperature is raised by the spent steam to 70° and over at times. In the trickling filter house the air was wet and steamy but without any trace of the offensive odor of ordinary sewage.

In the latter part of his paper, Mr. Winslow summarizes the present problems as follows: When American sewage is treated in the septic tank what causes the marked variation in the results obtained? Are periods of septic action of less than twelve hours desirable? For subsequent treatment, what are the comparative merits of the contact and the trickling filter? If the trickling filter be used, what is the cheapest system for securing adequate distribution? With intermittent filters, how rapid a rate can be attained under practical conditions, and by what frequency of dosing? These are some of the general questions which press for settlement and whose solution in one set of experiments will be of value, when corrected for local differences, in every other case.

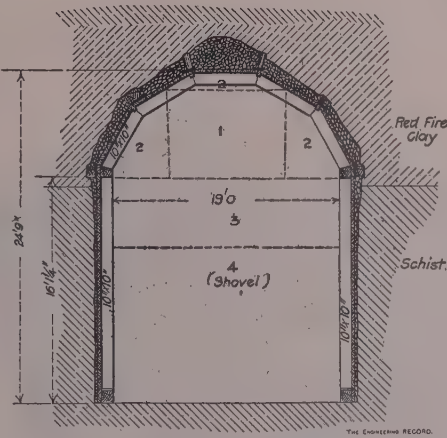
Clover Fork Tunnel, Coal and Coke Ry.

The accompanying illustrations show the plan and profile of the Clover Fork Tunnel near Jacksonville, W. Va., on the Coal & Coke Ry. The first work on the west approach was started Jan. 1, 1904, and on the east approach a little later. A C-20 Barnhardt steam shovel was used on the east approach and afterward in taking out the lower part of the bench of the tunnel, as indicated in the cross-section. The material from the shovel was handled by two 12-ton Vulcan dinkey locomotives and trains of six 4-yd. cars. Compressed air for running the shovel and six drills was furnished by a 20x22½x24-in. Ingersoll-Sergeant compressor.

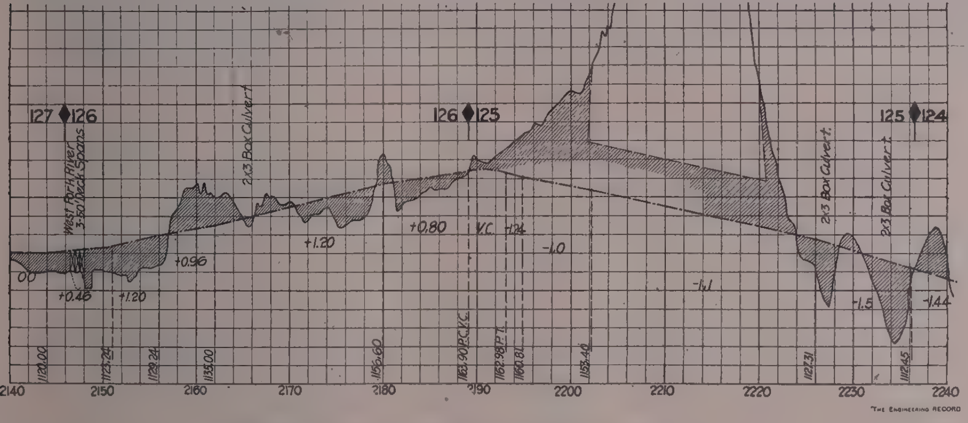
The cross-section illustrated was taken about at the half-way point in the tunnel, but the fire clay and shist there shown was the only material encountered up to the time these notes were taken. The tunnel was started with the heading, 1, the three sections marked 2 were then taken out, and finally the bench, 3, was removed. This was all hand work, the lower part marked 4 being taken out with the shovel. The order of operations 1 and 2 was reversed in wet material.



Location of Coal & Coke Ry. near Clover Fork Tunnel.



Typical Cross-Section.



Profile of Coal & Coke Ry. near Clover Fork Tunnel.

The segments, wall plates, sills and plumb posts are all 10x10-in. timbers and 3-in. lagging is used. The section is to be lined with concrete without removing the timbering.

The chief engineer of the company is Mr. Ashton A. Chapman, and the resident engineer is Mr. F. H. Cothran, of Jacksonville. The contractors are Messrs. Hoover & Kinnear, of Columbus, O.

The Most Economic Type of Hydraulic Power Conduits.

Address by Mr. Fred C. Finkle before the Twelfth Irrigation Congress.

In Southern California the streams are limited in their flow during the irrigating season, and reservoir sites are very scarce, and with few exceptions we do not expect much from that direction in future. We are blessed in another way. Although we lack reservoir sites, we have a precipitous fall in all of these canyons, which can be utilized for the development of electric power. I am satisfied that some of our rivers have falls as great as 350 ft. to the mile. While the streams are small, we sometimes obtain considerable horse power from them. I may mention one stream on which I constructed a power plant for the Edison Electric Co. of Los Angeles, known as Milk Creek, where 24 second-feet of water flows in average years. We have constructed a power plant on it by means of less than seven miles of conduit, which gives us about 4,000 hp. available, the fall at the station being nearly 2,000 ft., which registers about 840 lb. to the square inch at the nozzles.

One of the most important questions we have had to meet is the proper design and proper materials for constructing power conduits. In early days our power conduits were constructed mostly of cheap materials, generally wooden flumes which were hung on the sides of the mountain, and at every storm that came up they would be broken or damaged by rolling boulders or landslides above them, so the engineering profession has been compelled to give a good deal of study and investigation to the matter of designing something permanent. You can realize the utter importance of having an uninterrupted service in a power plant. It is not only necessary where you are furnishing power to light cities and run electric railways, but also where you are pumping water for domestic use and irrigation. These disasters to the early and crude power plants were very bad and caused the whole matter to be looked upon with suspicion and investors were not eager to put their money in the securities of these power plants. From my own experience I have come to the conclusion that there are two available methods, but before I outline these to you I wish to state briefly the conditions usually encountered in building conduits, referring particularly to California. The waters in California are all diverted at the base of the mountain ranges and distributed over the bench lands, so that power plants in the valleys practically do not exist. We have only one power plant in the valleys, and that is on Mill Creek, known as Mill Creek No. 1, which diverts the water at the mouth of the canyon and carries it two miles. All of the other structures are in the mountains, where you have to contend with vertical bluffs and steep sides of the mountains, scantily covered with vegetation, and when the heavy rains occur in the winter landslides come down these mountains and almost any kind of structure exposed on the surface would be very undesirable.

The mode of construction which I have now practically decided upon is a concrete and cement pipe. We make this pipe in 2-ft. sections by mixing the ordinary gravel and sand which we find in the waters and screen through a coarse screen, with one part of Portland cement. The pipe is laid in trenches dug to a depth sufficient so the pipe will be below the influence of landslides and to prevent it from being broken by rolling stones coming down the mountain. In some places we find it impossible to excavate these trenches on account of the vertical bluffs, and in these cases we construct a tunnel. These pipes are laid on a uniform grade, usually determined by the velocity that it is safe to give the water in the pipe, for it is not advisable to make the velocity greater than 5 ft. per second, as to make it greater would have a tendency to wear the pipe. The joints are made by means of a cement collar put on the outside, made half of sand and half cement and covering the entire circle of the pipe. This collar is put on by men wearing rubber gloves, who press it down carefully. Inside of the pipe we plaster the joint with cement, and this makes it a perfect joint. We now have three power plants which have been constructed in this manner, and they have proved an excellent success, having had no interruptions in the service of any of them. One of them has been in use six years, and that is a thing that never has occurred when flumes or other surface structures were used.

In Southern California we have developed all of our smaller water powers and have had to go farther north. The Kern River is now the principal source from which new developments are being made. The Edison Development Co. is building a plant on the Kern River which will develop an enormous amount of land and give us 28,000 to 35,000 hp. in Los Angeles. This quantity of water is so great that a conduit of the nature I described would not be possible. A conduit 48 in. in diameter I have never found to be successful. For this particular purpose we are driving a tunnel 9 ft. wide and 9 ft. high in the rough. When lined with concrete inside it will be 8 ft. wide with a water-carrying cross section 7 ft. in depth, the upper part being arched over in a circular form to sustain the formation. We find that by the use of this tunnel we shorten the line which would be occupied by a flume from about 14 miles to 8½ miles.

Although the tunnel will cost more than a flume, it will be a perpetual thing when constructed. A tunnel of this character, if driven through the rock, will be a thing which for all practical purposes we may say will endure forever, while a flume under the very best conditions is only good for 15 or 20 years. Besides, the other objection which I mentioned—namely, interruption to the service—is a vital matter. Companies which built flumes in the early days have abandoned them and built tunnels. There was one company at Bakersfield which originally built a flume and had so many interruptions that within three or four years after the flume was built they drove a tunnel. For a large flow of water the tunnel is the most economical form of power conduit. The problems an engineer must meet are cross-section and grade to be adopted for each particular grade. As to the grade to give such a tunnel, what governs me almost entirely is the velocity which the concrete work inside such a tunnel will stand. My reason for concreting these tunnels is that in this way you can save considerable on the first cost of the work and reduce the coefficiency of roughness. My method of concreting is to use 4 parts of crushed rock and 3 parts of sand to 1 part of cement in the lining, 3 to 4 in. thick, and plastering the whole surface with a mixture of 1 to 2 sand and cement, applying, say, ¼ in. to give a smooth surface and prevent percolation through the cement. By means of this construction the coefficient of roughness in the Kutter formula has been reduced as low as 0.01, and in other cases it has been as high as 0.012. If the work is very poorly done, it might run to 0.013, but I have never had a case of that kind in my experience. Of course, the first investment in a power plant is made greater by means of this class of work.

In California, where timber is quite abundant, a flume can often be constructed very cheaply, but by figuring the cost of maintenance of such a plant, the loss to the company by interruption to its service and consequent loss of reputation, etc., and cost of renewals, which are very great on all timber structures, the figures show that, although higher at first, the other system is cheaper in the end. I deem this subject one of considerable interest to the Reclamation Service, for unquestionably they will meet with problems of this nature, and what I have said in regard to the economy of a power company of course applies fully to the Reclamation Service wherever the plant is for power purposes, and where it is not for power purposes it applies to a considerable degree. Of course, many of us in our first practice as irrigation engineers had to do more or less timber work in the arid parts of the United States. The companies often allowed us only a certain amount of money to do the work, and the habit grew up among the hydraulic engineers of the West of doing a great deal of timber work. The results have not been very satisfactory. Many of the systems are in such a condition that they have to be reconstructed or give very inefficient service in the future. In irrigation it is possible to forego the use of the water for a short time when a break occurs in the canal or conduit, but it is not possible in the case of power; and I might state that the development of power is what first called our attention to the necessity for doing permanent work, and this necessity is now coming to be recognized by engineers engaged in reclamation work.

PEAT BRIQUETTES are being manufactured at Orlando, Fla., for fuel for the local water and electric lighting station. The Leavitt briquetting machine is used.

Reconstructing the Flumes on the Turlock Irrigating Canal.

By H. A. Crafts.

The main canal of the Turlock Irrigation District in Stanislaus County, California (see The Engineering Record of Sept. 17 and 24, 1904), has been in operation now four years. It is one of the largest irrigating ditches in the United States, having a capacity sufficient to carry 1,500 cu. ft. of water per second. The original cost of the system, including half of the cost of the diverting dam across the Tuolumne Canyon at La Grange, was $2,500,000. There was a long delay in the construction of the system on account of litigation that was very expensive, and to meet the cost of lawsuits, defaulted interest, completion of the constructive work and of repairs, an additional million dollars were raised. Of this amount $200,000 was set aside for repairs, and of this latter amount $87,000 have been expended. It might appear to some that a work of such recent construction would hardly require the amount of repairs implied by the sum of money set aside. But this point will be readily understood when it is known that the head works of the canal extend through a 22-mile belt of the Sierra Nevada foothills, and that in that distance not less than four large ravines are crossed by means of wooden flumes. It is in these flumes that the weak parts of the system lie, and it is for the reconstruction of these parts that the money appropriated is being, and is to be, expended.

Retaining Wall at Snake Ravine.

The Morgan Gulch Flume.

There are four principal flumes on the line, those crossing Snake Ravine, Morgan, Peaslee and Delaney gulches. The longest of these is the Snake Ravine flume, which was originally 1,540 ft. in length. The flume was of Oregon pine lined with California redwood. It was 13⅔ ft. wide in the clear and rested upon the bed of the ravine, and for the most part on mud sills. Six years' use of this flume has resulted in serious decay of the floor sills and of the lower ends of the posts.

In 1904, Prof. Samuel Fortier, of the department of irrigation engineering of the California College of Agriculture, was called in as consulting engineer, and he gave the opinion that it would be unwise to attempt to repair the old structure. On the contrary, he advised a change of policy that would bring about permanent reconstruction. He presented two methods by which the desired end might be attained, viz.: First, the filling in of the entire basin across which the flume had been built with material sluiced down from the adjacent tableland by hydraulic process; second, excavating a shelf in the rocky formation to the left of the old flume and forming a canal channel by means of a masonry retaining wall on the lower side. Prof. Fortier was inclined to favor the latter scheme, and his recommendation was adopted by the directors of the irrigation district.

The work, according to plans laid down by Prof. Fortier, was completed in the season of 1905, early enough for the operation of the canal as soon as water was at hand for irrigation. The work of reconstruction through Snake Ravine was not, however, of a uniform character. About 800 ft. of the middle portion of the canal was built more strictly in accordance with the plan presented, viz.: With a concrete masonry retaining wall on the lower side. Over the upper 200 ft. a concrete lining resting on dry rubble masonry was put in. The lower 600 ft., being in porous gravel, had both bottom and sides built up of selected puddle. In making this change the new channel of the canal was enlarged to the full carrying capacity of the ditch, 1,500 cu. ft. per second, whereas the carrying capacity of the old wooden flume was only 500 cu. ft. per second.

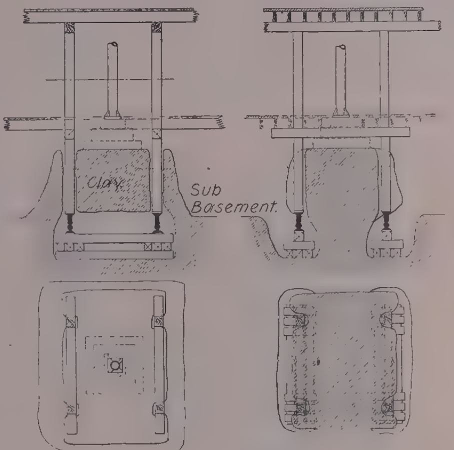
One of the accompanying illustrations shows a section of the concrete retaining wall of which the middle portion of the new work is composed. The wall is 12 in. thick on top and at the point exhibited 4 ft. 6 in. thick at the base. The length of the wall varies from 10 to 17 ft. The outside batter of the wall is one inch in twelve. The concrete composing the wall was mixed in the proportions of one part Portland cement, 2½ parts sand and 5½ parts gravel. The opening in the retaining wall, shown in the illustration, was designed for a gate and flushway to be used in clearing the ditch of sediment. The cost of the Snake Ravine project was $28,000.

The flumes crossing Morgan, Peaslee and Delaney gulches were also found in a weakened and dangerous condition, and Prof. Fortier recommended replacing the wooden structures with inverted siphons of 6-ft. steel pipe. This recommendation is made from the fact that the physical features surrounding the flumes render it impossible to treat them like the flume across Snake Ravine. The gulches are deep and cannot be got around; they must be spanned. The present flumes are mounted on high wooden trestles, and the trestle work is decaying rapidly, especially where it rests upon the ground. But the directors of the district are inclined to be conservative, and are rather slow to adopt at once the steel pipe inverted siphons. It has been decided to replace the wooden flume across Morgan gulch with a new wooden flume supported by steel supports. The flume is 289 ft. long and the support will be 265 ft. long. It will be 50 ft. from the top of the masonry foundation to the bottom of the flume. The decision is to make temporary repairs on the Peaslee and Delaney gulch flumes and eventually replace them with the inverted siphons.

American Street Railways have been developing well, according to the last annual summary of the "Street Railway Journal," which reports for 1904 a total length of 30,187 miles, as compared with 28,456 in 1903. Of this total in 1904, 29,548 miles are electric roads, on which there were 59,625 motor cars, 6,900 trailers and 5,475 service cars. The length of cable, steam and horse railways decreased from 702 in 1903 to 639 in 1904. The capital stock of all these railways in 1904 was $1,761,571,812 and their funded debt $1,455,520,159, a total of $3,217,091,971 of capital liabilities. This represents an increase of $134,839,324 over the figure for 1903. It is equivalent to 44 per cent. growth, while the increase in the mileage and rolling stock was much less.

The Collapse of the Meyers Building, Albany

The building occupied by the department store of the John G. Meyers Co., of Albany, covered an irregularly shaped lot, approximately 50 ft. wide and about 200 ft. deep on a steep side hill. It extended across a block and had fronts on both streets. It had brick exterior walls from three to six stories high, one center longitudinal row of cast-iron columns, wooden floor beams and floors. It had been formed by the combination of several old dwellings which originally occupied the site, and had been from time to time connected and altered. Much of the timber and brickwork was sound and strong, but the details and connections were not efficient, and the construction was not adapted to work together as a whole nor to develop the full strength of individual members. The construction was notably heterogeneous, repairs and alterations having been made at different times without much regard to structural uniformity. For example, when the longitudinal interior wall was removed a horizontal strip 2 or 3 ft. high was left intact at each floor line, apparently to avoid resetting the ends of the floor beams which it supported. This brickwork was seated on unequal flanged, cast-iron lintels, supported by the cast-iron columns, which were not even set in line, but were several inches eccentric in the successive stories.



Underpinning Methods.

An attempt was being made recently to excavate a sub-basement under the basement while the building was occupied. The contractor simply proceeded to excavate first and underpin afterward, and while doing so a part of the building collapsed, as noted in this paper on August 19. The soil was a stiff, moist clay which stood well with a vertical face. Under a considerable portion of the building it was excavated to a depth of 5 ft. below the bottom of the column footings and close to them, leaving one column seated on a pier of clay about 8 ft. square at the top, with approximately vertical sides from 3 to 5 ft. high, and two others on the edge of a clay bank, excavated on one side 5 ft. below the bottom of the column footings and to within 3 ft. 9 in. of the center of the columns.

The clay pier and bank carried the loads from long-span beams in several upper floors. After the excavation had been completed around these clay piers their faces were recessed to receive four vertical shores seated with jack-screws on timber grillages. In order to make the grillages concentric with the shores the lower faces of the piers were undercut considerably, and the grillages were set in these spaces trenched below the bottom of the main excavation. The shores were capped and wedged up against the first-floor floor beams. The column was also suspended from these floors allowing the clay pier to be excavated from between the shores and the new masonry pier to be built in its place.

One of the old columns had been thus supported, the old footing and the clay pier under it had been removed, and a new masonry footing had been built for it. The shores were in place for another column, but were not yet supporting it. Excavation had been made around two sides of one column and close up to its footing on one side of two other columns, leaving the steep faces of the clay pier and bank under heavy pressure and in no way confined or sustained. The columns were not even central on the piers. Warning by cracking and settlement is said to have been given for an hour before the clay piers crumbled and collapsed, letting the columns fall and bringing down a large part of the floors and interior walls of the building, which contained many employees, many of whom were killed and many more injured.

After the disaster an examination of the building was made by Messrs. W. A. Cattell, William F. Hanrahan and Charles P. Boland for the Mayor of Albany, and extracts from their report follow:

"The buildings occupied by the John G. Meyers Co. were originally private dwellings. They were altered and enlarged from time to time, and it appears that the principal alterations previous to those in progress on Aug. 8 were made in 1881. These alterations of 1881 (which we understand consisted principally in cutting out the center walls and substituting cast-iron columns and lintels therefor), together with the defects in the original construction of the dwellings, made the undermining and underpinning of this structure an exceedingly difficult and dangerous operation. Many of these defects were concealed by subsequent construction, but it does not appear that any thorough examination of the old buildings was made before the work was started, to ascertain if any structural weakness existed.

"The work in progress on Aug. 8 was that of excavating under the walls and columns supporting the base and upper stories of the building, and of underpinning these walls and columns for the purpose of constructing a sub-cellar. The work was started from the James St. end of the building, and at the time of the collapse the excavation on the northerly side of the building had been completed as far as it was intended to carry it, viz., to column No. 6 (numbering from the James St. end). The excavation under the southerly half of the building had been carried to a point about half way between columns Nos. 10 and 11. This portion of the excavation was completed approximately to grade, which was about 5 ft. below the bottom of the old column foundations, and to a line averaging about 3 ft. 9 in. south of the centers of the columns. The excavation around column No. 7 had been carried down to grade to a line about 8½ ft. north of the center of the column in a westerly direction to a point about 5 ft. from the center of column No. 8. Column No. 7 was supported on shores and needles of ample size and strength to carry their load, and the concrete base for the pier supporting this column had already been placed. The excavation around column No. 8 had been completed approximately to grade on the south to a level about 3 ft. below the bottom of the column foundation on the north and west, leaving a pier of clay approximately 10 ft. square at the bottom of the column foundation, unconfined on the south and east and only partially so on the north and west. This column, however, was not located over the center of this clay base, but was approximately 3 ft. 4 in. from its south edge and 4 ft. 8 in. from its east edge. There was no shoring in place at columns 8, 9 or 10 at the time of the collapse, the special work in progress on the morning of Aug. 8 being that of putting in the needle beams around column 8 preparatory to placing the shoring. There is no evidence that any means were adopted to confine this column of clay supporting column

8, nor the bank of clay on the edge of which columns 9 and 10 rested.

"From the foregoing it will be seen that on the night of Aug. 7 columns 8, 9 and 10, each of which carried a very considerable load, were left standing on the edge of an unconfined bank or pier of clay, and it is our judgment that the collapse of the building was caused by the settlement of the clay under one or more of these columns, due to the pressing out laterally of the unconfined material supporting the foundations of the old columns. It is our further judgment that the conditions existing at this building and the character of the work in progress demanded that extraordinary precautions be taken to insure safety. Had such precautions been taken, the disaster could have been averted."

An Unusual System of Wells.

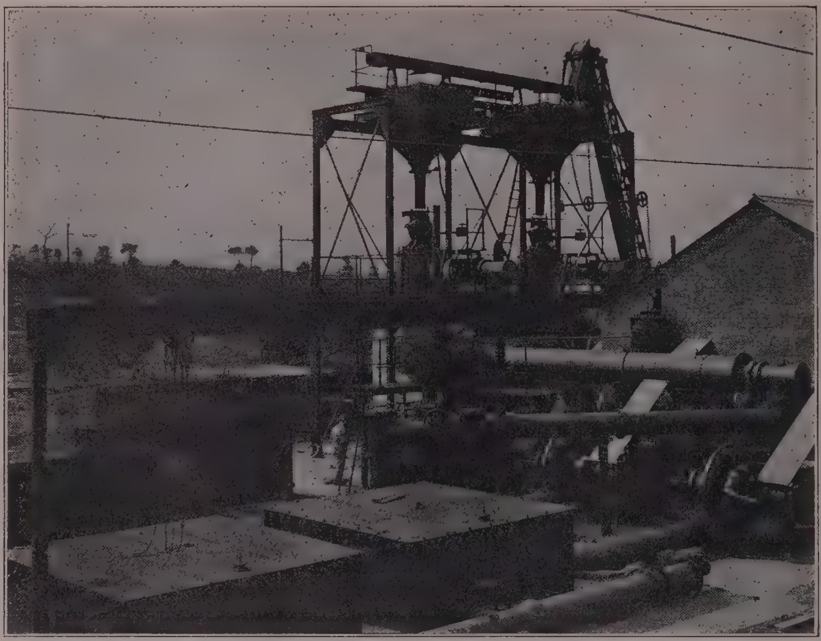
The system of new wells forming a portion of the water-works of Hastings are of an unusual character. A number of years ago, when the first sources of supply proved inadequate, it was impracticable for various reasons to secure additional water except in one locality. Here two well, known as Nos. 1 and 3, which are situated on the northern side of a valley, have been sunk to a depth of 270 ft.; and well No. 2, which is situated 900 ft. away from Nos. 1 and 3 and on the southern side, to a depth of 210 ft. The wells are each 9 ft. in diameter, and lined with cast-iron cylinders to a depth of 60 ft. below the surface; below that point to the bottom they are lined with 9 in. of brickwork built in Portland cement mortar. The brickwork is backed up with clean rubble, and apertures are left wherever water was met with, so as to allow free access to the well.

Wells 1 and 3 are connected by a heading 10 ft. from the bottom of the wells. Well No. 1 is connected with well No. 2 by a heading driven right across the valley. Owing to the treacherous character of the material met with in this heading (consisting largely of blue marl), and which on exposure to air and water quickly collapsed, it had to be lined throughout with concrete block 9 in. in thickness. These blocks, which were made on the site, are composed of 6 parts of shingle, 2 of sand and 1 of cement, the arch and invert being made to radius. The headings are 6 ft. in height by 4 ft. in width at the springing, and 3 ft. 6 in. at the invert. In addition to the main headings, there are branch headings—one running in a southeast direction from No. 3 well, and others running from No. 2 well to a borehole made in the preliminary testing of the site.

Owing to the presence of oxide of iron in the water, the well pumps deliver into an aerating chamber, 36 ft. in diameter, through a trumpet-mouthed pipe, with a second overflow basin. The water from the aerating chamber flows over a gauge into a valve chamber, and is filtered through four polarite filters working under a head of 12 ft. They are each 15 ft. in diameter and 10 ft. in height; each filter contains three perforated trays, made of reinforced concrete, the space between each tray being packed with polarite, one filter always being kept as a standby. The water is taken into the top of the filters through a 6-in. pipe, and the filtered water taken from the bottom. To cleanse either of the filters it is only necessary to shut it off from the filtered water main and reverse its action. The water, after passing through the filters, is taken to a pure water chamber, 23 ft. by 23 ft. by 14 ft. in depth; this chamber is built in concrete and lined with white-glazed bricks, covered with rolled steel joists and concrete roofing, being entirely below ground. The works were designed by Mr. P. H. Palmer, borough engineer of Hastings.

The Gas Engine Station of the Sunderland District Tramways.

The Sunderland District Tramways connect with the municipally owned lines in Sunderland, England, and run through a large number of small towns in the vicinity which were without railway service of any sort before the electric lines were built. The system is 17 miles long, all single track. The power station is particularly interesting as it is operated by producer gas furnished by Mond apparatus, made in the United States by R. D. Wood & Co. The Sunderland plant includes two producer units, together with the necessary subsidiary apparatus, such as gas cleaners, governor, coal-handling plant, etc. The producers are of cylindrical shape, and consist of internal and external wrought-iron shells; the blast, which is delivered by a Roots blower, enters the external shell near the top and passing downward becomes superheated before passing into the combustion chamber through the grate. The fuel bed is kept at a constant level by an internal bell which connects directly with the hopper; poking holes are provided, so that the whole of the fuel bed can be reached and if necessary stirred without any appreciable escape of gas. By means of a water seal the ashes can be withdrawn at any time while the producer is in operation.



Power Gas Generating Plant, Sunderland District Tramways.

The gas from the producers passes straight into the mechanical washer, where it comes into contact with water thrown up in a very fine spray. This removes the dust and at the same time causes a considerable lowering of temperature. Any tar or other impurity that may still remain in the gas is removed by passing it through a specially constructed fan and finally through a sawdust scrubber. The plant is entirely automatic in operation, being fitted with a governor, which, in conjunction with the blower, accurately controls the production of the gas as it is required. The coal is fed into the bunkers by a bucket elevator and screw conveyor capable of dealing with 5 tons of coal per hour. The steam required for the operation of the producer is raised in multitubular boilers heated by the exhaust gases from the gas engines. Besides supplying the necessary moisture in the producers, the steam is used to drive two small single-cylinder engines belted to fans. A supplementary boiler, coal-fired, is provided as a standby and for initially starting the plant. By this plan it becomes unnecessary to use extra coal for steam raising, and a maximum economy is secured.

At the side of the yard opposite to the producer stands the power house and office building. The offices of the tramway are on the first floor above the battery room, while the generating plant occupies the other end of the building. The two gas-driven sets are of 210 b.h.p. and 330 b.h.p. capacity, respectively. The engines are of the Crossley Brothers two-cylinder vis-a-vis type, specially constructed for working on producer gas; the larger one has cylinders 25 in. in diameter by 30-in. stroke, and runs at 150 r.p.m., while the smaller has cylinders 18½ in. in diameter by 27-in. stroke, running at 190 r.p.m. Both machines are, of course, fitted with heavy fly-wheels to smooth out the cyclic irregularity common to gas engines, the fly-wheel of the larger engine being 11 ft. in diameter by 26 in. wide, and of the smaller engine 9 ft. in diameter by 22 in. wide. Electric ignition is used and duplicate igniters, which can be fed from the dynamos driven by the engine, are supplied as a standby. The larger engine has balanced and water-cooled exhaust valves, and also water-cooled pistons. Both engines have been specially designed to make the wearing parts as easily renewed as possible, with a view to reducing the cost of upkeep. The pistons are made with loose liners, which when worn can be easily withdrawn and renewed at small cost, and the pistons of the in-running cylinder are fitted with slipper guides to take up any wear that may occur. The side shafts of the engines which carry the cams for operating the different valves are driven by steel machine-cut scroll wheels, each engine having an independent side shaft and governor. The engines are started by compressed air, the compressor being driven by a small Crossley gas engine. Hand-barring gear is, of course, provided for each engine.

Underground Water Development in Southern California has been carried too far, according to Mr. F. C. Finkle, of the Edison Electric Co. of Los Angeles. So much water has been drawn from these sources that the latest projects have proved failures, owing to scanty supplies. In one valley about 100 miles long and 20 miles wide about 3,000 hp. in electric motors and a large number of gasoline engines are at work pumping this underground water for irrigation.

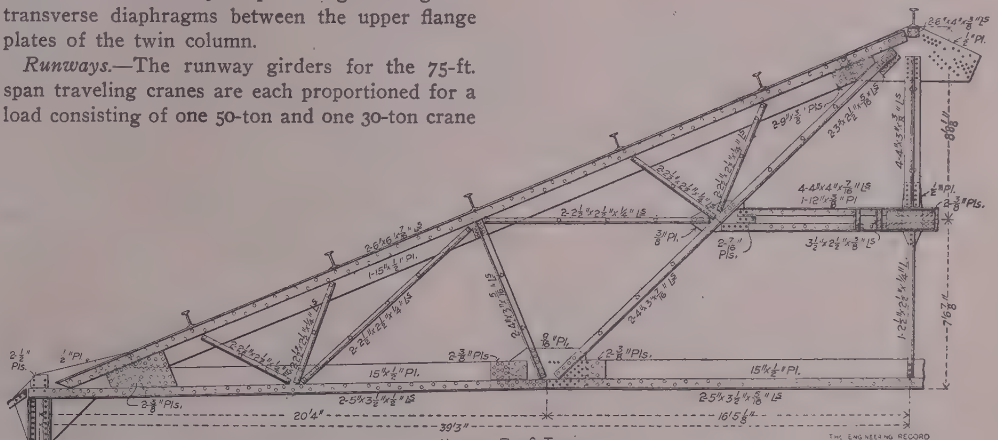
Steelwork of the New General Electric Machine Shop.—II.

Machine Shop from Side Designed for Future Extension.

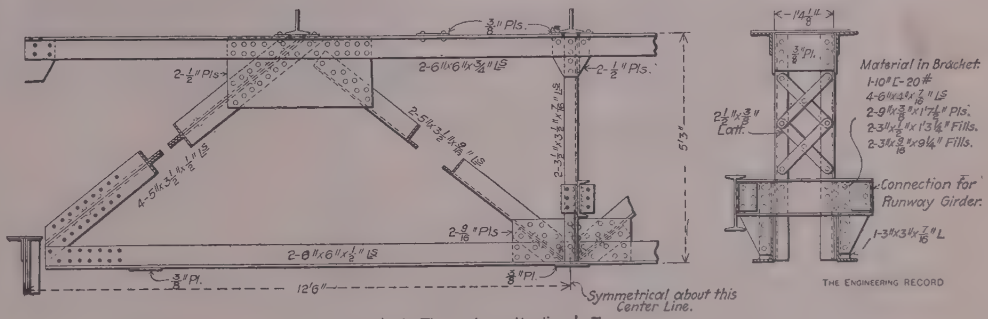
Special Columns.—The most interesting details in the framework are those of the tall and heavy columns calculated to carry roof, floor and crane girder loads. The columns in the center longitudinal rows are of somewhat complicated construction and are shop riveted complete in single pieces about 62 ft. long, which weigh approximately 17,500 lb. each. They have I-shaped cross-sections, with the long dimension in the plane of the roof truss. The lower part of the column is made with a 26½-in. web plate and four flange angles reinforced by channels. Above the upper runway girders the dimensions are reduced, and the web and one pair of flange angles is of smaller size and is shop spliced to the web of the lower section. The lower runway girders are seated on massive brackets riveted to the column flanges. These brackets have three vertical webs transverse to the runway girders and one vertical web in its plane. The upper runway girders are seated directly on that portion of the web and flange of the columns which terminates at this height, thus directly loading the end of the column. The beams and girders are web-connected to the column webs and flanges, as indicated at different points in the drawings. The runway girders are also web-connected to the columns by vertical transverse diaphragms field riveted to them and shop riveted to the columns. At the upper end of the column a portion of the web plate is omitted and the angles are continued beyond it to form jaws to receive the field-riveted connections with the inside plates in the roof trusses.

The columns in the erecting-shop aisle are practically twin members, designed not only for the purposes of the present structure, but so as to form part of a similar adjacent building which may be erected in the future. Each column weighs approximately 24,000 lb., and consists of two I-shaped columns latticed together in the transverse plane with zigzag angle bars. The lower crane runway girders are supported from it by short transverse plate girders, with their webs shop riveted across the flanges of both columns. These girders project on the inside of the building beyond the flanges to provide the girder seat. On the outside of the building there is no projection, but full holes are left for a bracket connection which may hereafter be added to correspond with the other end girder and form the seat for a runway in the extension. The twin columns terminate at the level of the lower flange of the runway girders for the upper crane system. Here they are connected by wide flange plates and have horizontal angles and coverplates forming seats for the girders in the present shop and for those which may be added in the future shop. The tie plates connecting the tops of the columns also serve as jaws between which the base of the lighter extension is shop riveted. This extension is a column with I-shape cross-section which has at the upper end an inside solid web kneebrace bracket to receive the roof truss and on the outside is fitted with field holes to receive a corresponding bracket when required for the future adjacent building. The connection at the foot of the column is made by shop riveting its flanges to transverse diaphragms between the upper flange plates of the twin column.

Runways.—The runway girders for the 75-ft. span traveling cranes are each proportioned for a load consisting of one 50-ton and one 30-ton crane traveling over them as close as possible. This gives moving loads of 86,000 lb.—12 ft.—86,000 lb.—4 ft.—55,000 lb.—11 ft.—55,000 lb., to which is added an allowance of 25 per cent. for impact. The lower sections of the columns are calculated for one 30-ton crane and one 50-ton crane on one runway and two 30-ton cranes on the other runway. The runways are made with duplicate plate girders in 24-ft. 11½-in. lengths, seated on the column supports with abutting ends, which are field riveted by vertical web-stiffener angles to transverse diaphragms shop riveted to the columns. The lower flanges are knee-braced to the columns and the top flanges are reinforced by a 12-in. 35-column channel riveted to it, flanges down, on which the 100-lb. rail is bolted without connections. The web is a single plate with a uniform thickness of 9-16-in. and the flanges are made with 6x6x⅝-in. angles. At the fixed ends the girders are riveted together and to the column caps. At the expansion end vertical web-stiffener angles are riveted together with their offstanding flanges and one pair of the flanges is secured to the web by bolts through full holes that allow for temperature movements.



Heavy Roof Truss.



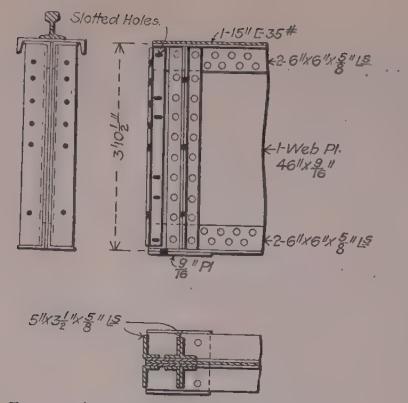
Third Floor Longitudinal Truss.

Roof and Floor Truss Details.

Floor Girders.—The longitudinal floor girders have their webs made with full-length plates ⅜ or 5-16-in. in thickness. The second floor longitudinal girders in the center of the three-story aisle, 45 in. deep, have the flanges made of pairs of 6x6-in. angles without reinforcement, and the connections for the 24-in. I-beams are made with shelf angles having their horizontal flanges reinforced by the fitted upper ends of vertical web-stiffener angles, which are continued to the lower flange on that side of the web and are made full-length on the opposite side. The second-story longitudinal girders connecting the center columns have a 72x5-16-in. web, which is field riveted at each end to the flanges of the columns. The girder has pairs of 5x3½x⅜-in. bottom flange angles reinforced by a channel, flanges down.

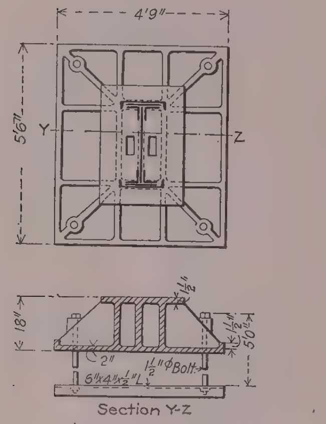
In the second floor the cantilever I-beams which project through the central row of columns to carry the loading platform in the erecting aisle take bearing on the top flanges of a double web plate girder 48 in. deep, which is connected at both ends to the webs of the columns. The girders have 6x4-in. flange angles reinforced with a 16x¾-in. coverplate, and the webs are connected at the center by a shop riveted vertical transverse diaphragm.

In the third floor the cantilever loading plat-



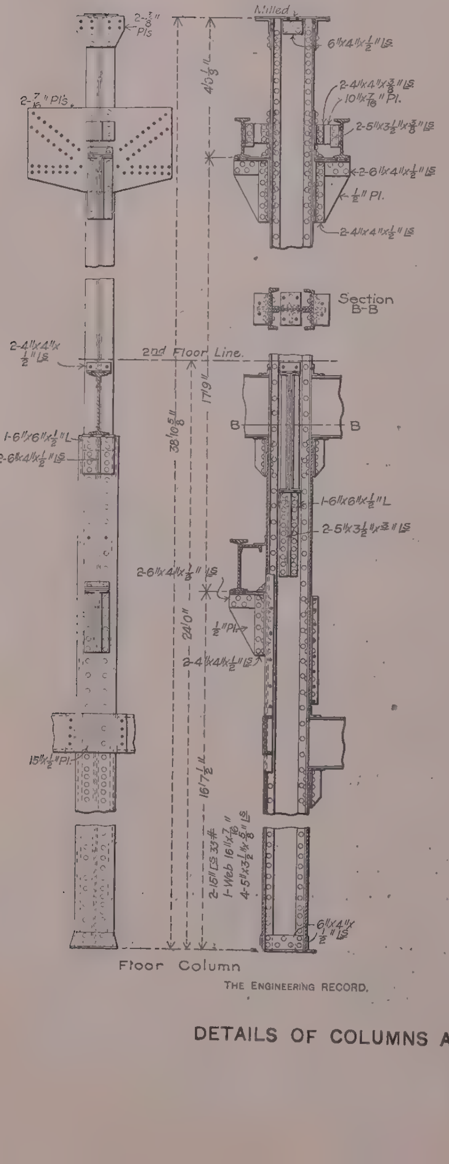
Expansion End of Runway Girder for 30 and 50 Ton Cranes

THE ENGINEERING RECORD



Typical Column Base

THE ENGINEERING RECORD



Floor Column

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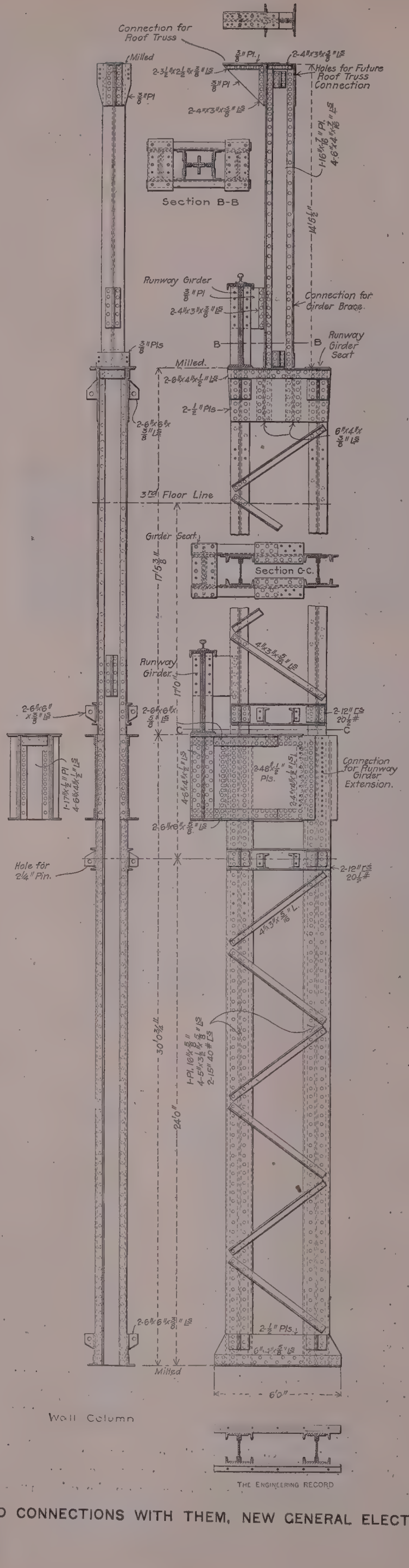

Wall Column

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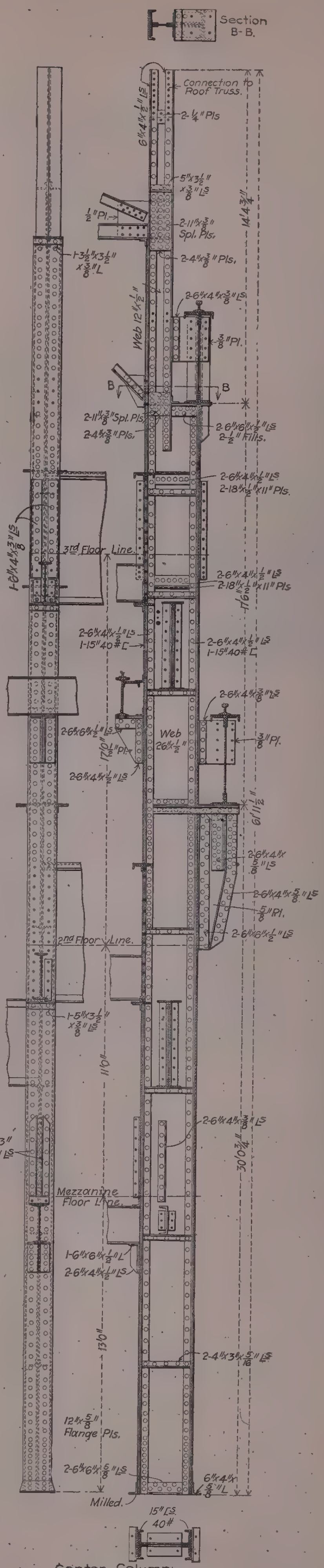


Center Column.

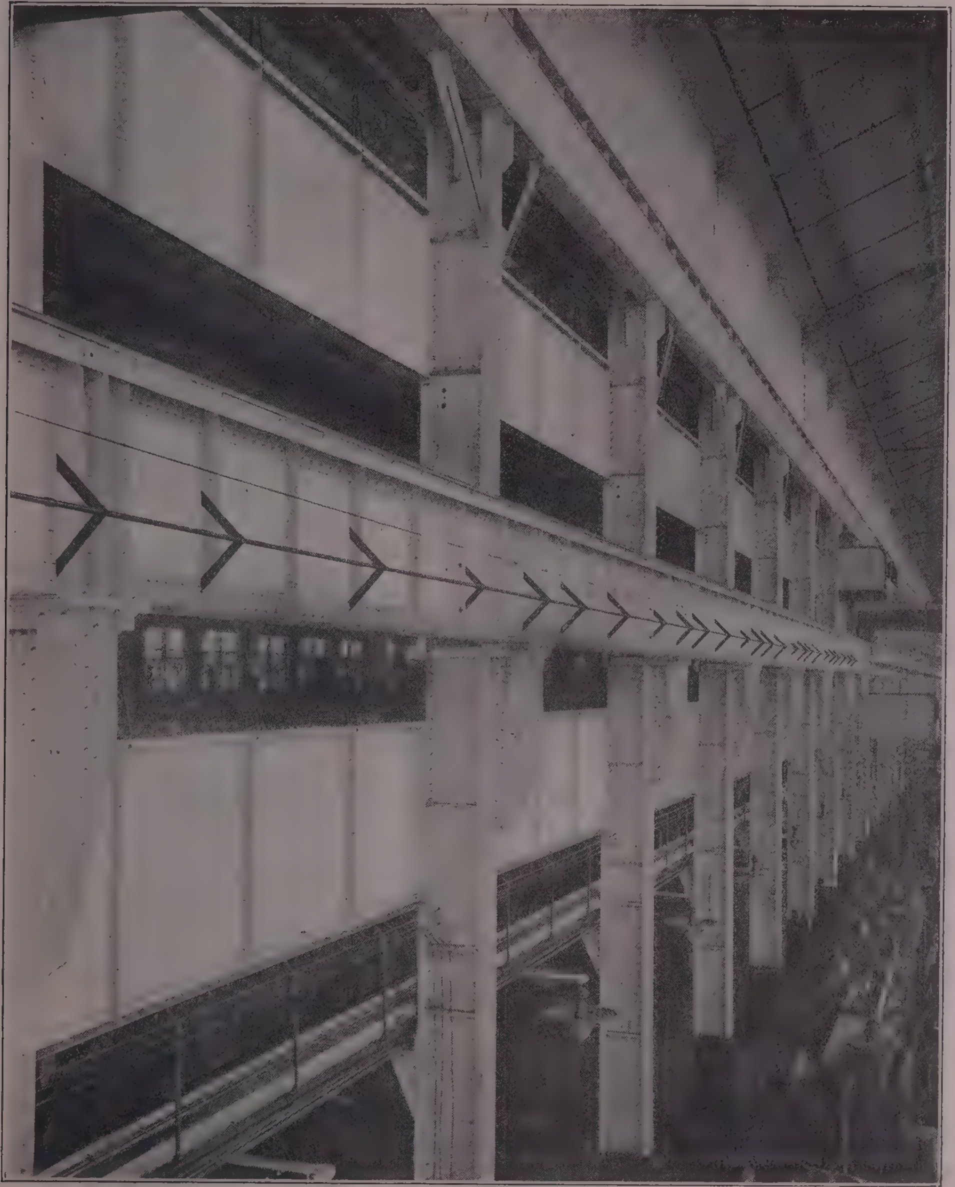
THE ENGINEERING RECORD.

DETAILS OF COLUMNS AND CONNECTIONS WITH THEM, NEW GENERAL ELECTRIC MACHINE SHOPS.

form has longitudinal I-beams field riveted to the lower part of the webs of a pair of bracket girders. These girders are 12 ft. 8¾ in. long and 59 in. deep, with 5/16-in. web plates and 3½x3½-in. flange angles. The outer upper corner is rounded and the top flange and end angle are reinforced by a 10-in. channel, flanges down. The web projects across both flanges of the center column and is connected to it by two vertical rows of field rivets.

The third-floor girders connecting the single longitudinal columns are similar to the corresponding ones in the second floor and have webs 16 in. deep. The bottom flange angles are 5x3½ in. and the top flanges are pairs of 3½x3½-in. angles with a 10-in. reinforcement channel. Fifteen-inch floor beams are field riveted to the two lines of vertical webs just clear of the lower flanges.

Around the elevator shafts and stair wells there is a protecting railing which, instead of being made with open work, consists of very light plate girders having the web made of No. 8 U. S. standard sheet steel. The top flange is made of a single 4x2-in. T-bar and the bottom with a single 3x3-in. angle. The bottom flanges of these girders are riveted to the floor beams, and they are braced transversely by pairs of inclined angles with their upper ends riveted to the connections just below the top flange and their lower ends riveted to brackets attached to the webs of the 20-in floor beams.



Interior View of New Machine Shop.

On the center line of the three-story aisle the transverse beams in the third floor are seated on the top flanges of double longitudinal lattice girders 25 ft. long that are riveted to connection plates on the columns. These girders are riveted up complete at the bridge shops with their bottom flange connected with lattice girders and the top with tie plates, the latter serving as base plates for the floor beams. At the center of each girder the brackets are provided with web connections to carry the 15-in. I-beams for the crane runways parallel to the girders and 19 in. from their center lines.

The foot bridges which span the erecting aisle at the ends of the second and third floor level are simple riveted trusses 7 ft. deep, divided by vertical members into panels of about 6 ft., each panel being braced with a single 2½ or 3-in. diagonal angle. The top and bottom chords are each made with two 3x2½x¼-in. angles, back to back, with ¼-in. plates riveted between them at panel points for the connections of the web members. The verticals are pairs of 2½x2½x¼-in. angles, back to back, with horizontal 6-in. floor beam channels riveted across their lower ends. The upper chord is reinforced by a 10-in. channel, flanges down. The lower chords are braced together by zigzag 2x3-in. lateral angles field riveted to connection plates on the lower flanges of the floor beams.

Four of the roof trusses in the erecting aisle are proportioned to sustain a load of 60,000 lb. at center panel point. They correspond with the regular roof trusses in the same aisle, except that the sections are heavier and that the details are modified to correspond, as shown in the detail elevation. The top and bottom flanges have T-shaped cross-sections with 15x½-in. web plates, which gives them considerable strength to resist flexure. A horizontal plate girder strut is introduced in the center truss connecting each side with the vertical member to which may be attached lifting tackle for handling the crane bridges when necessary to place them on or remove them from the runways below. These trusses weigh about 15,000 lb. each, and, like the lighter trusses, were shipped from the bridge shops in two parts, field riveted together in horizontal planes and crown at site, and erected by the traveler derricks.

The total weight of the building is about 4,200 tons, and the steelwork was erected by two boom travelers, each consisting of a tower 90 ft. high, with stiff-leg derricks on top of the tower. The derricks were operated by double-drum four-spool hoisting engines carried on the lower sills of the travelers, and the steelwork was erected with a maximum rapidity of about 50 tons a day. The erecting gang of about 25 men was followed as closely as possible by the riveters, who drove all of the field rivets by hand. The erection of the building, including the riveting and painting, was accomplished in about 150 days.

The general designs were prepared under the direction of the engineering department of the General Electric Co., Mr. W. A. Pearson, chief engineer in charge of building construction. The contract was awarded to the American Bridge Co. of New York. The steelwork was fabricated at the Elmira, Athens, Pencoyd and Albany plants of the American Bridge Co. from detail shop drawings prepared under the direction of Mr. J. H. Edwards, assistant chief engineer, and in conformity with the general plans and specifications. The work in the field was in charge of Mr. H. F. Lofland, erecting manager of the Eastern Division of the American Bridge Co. of New York.

Copartnership System of London Gas Companies.

The copartnership system of the South Metropolitan and South Suburban Gas Companies of London is one of the most unique and successful endeavors to interest workmen in the welfare of great industries. These corporations give their men opportunities to invest in their securities sums proportional to their means, and permit the men to chose a few of the directors, who, it may be added, are generally credited with being valuable members of the two boards. In the case of the South Metropolitan company a few young men hold £5 interests, and a considerable number of older hands have invested £10 and £15; 470 held £20; 192, £25; 310, £30; 115, £35; 126, £40; 47, £45; 70, £50; 21, £55; 47, £60; 26, £65; 34, £70; and so on. There were 169 who held £109 and upwards at the close of the last year. When it is reflected that the class of men employed in gas works is not usually well educated or steady, the results accomplished by Sir George Livesey, chairman of the companies, by this system of co-partnership are worthy of careful attention. Some of his directors who originally most opposed the admission of workmen to their boards have recently spoken in the strongest praise of the results. One of them stated that since the system went into force there has been no labor trouble, while the men have themselves taken a personal interest in seeing that incompetent employes were reformed or sent elsewhere.

The Investigation of Structural Materials by the U. S. Geological Survey.

By Richard L. Humphrey.

Two interesting features at the Louisiana Purchase Exposition were the United States Fuel Testing Plant under the direction of the United States Geological Survey, and the collective Portland Cement Exhibit and Model Testing Laboratory of the Association of American Portland Cement Manufacturers. These were working exhibits which accomplished much good in an educational way, besides yielding valuable data relative to fuels and the various building sands and gravels of this country. They were conducted with funds available only for the period of the Exposition.

The important results which were obtained, and the valuable data to be obtained through a continuance of this work led to an earnest appeal to Congress on the part of Dr. Joseph A. Holmes, chief of the Department of Mines of the Exposition and Fuel Expert of the United States Geological Survey, and many others interested in the work, which resulted in a liberal appropriation for the continuance of the investigations of fuels and structural materials on a much more extensive plan. With the appropriation for structural materials, which became available in March of the present year, it was decided for the present to confine the work, commenced during the Exposition, to the investigation of sands, gravels, stone and other constituent materials of mortars and concretes, as well as to the study of mortars and concretes. The equipment of the model testing laboratory has been added to, and in this will be carried on the physical tests. In the Metal Pavilion, with a floor area approximately 59 x 100 ft., will be carried on tests of full-size specimens. The chemical and microscopical laboratory occupies commodious quarters in the building used for a model foundry during the Exposition.

This work is under the direction of Mr. Richard L. Humphrey, M. Am. Soc. C. E., of Philadelphia, and will include not only the work in the St. Louis laboratories, but that carried on under the direction of the Reclamation Service, United States Geological Survey, and the investigations at the various technological institutions, the latter in conjunction with the work of the joint committee on concrete and reinforced concrete.

The American Society of Civil Engineers about one and one-half years ago appointed a committee on concrete and reinforced concrete, with instructions to affiliate in its work with similar committees of the American Society for Testing Materials, the American Railway Engineering and Maintenance of Way Association and the Association of American Portland Cement Manufacturers. This joint committee appointed a subcommittee on tests, under whose direction was inaugurated a series of investigations in a number of technological institutions during the past school year. Owing to the insufficiency of funds for this purpose, and also by reason of incomplete inspection and the untrained character of the students who made the tests, it was not deemed advisable to carry on this work very extensively under such conditions. At a meeting of the joint committee at Atlantic City, in June, it was decided to co-operate with the Government in the investigation of structural materials, so far as they applied to concrete and reinforced concrete, and the Government agreed to co-operate with the joint committee in carrying on such tests and in supervising the work at those technological institutions engaged in these investigations under the direction of the joint committee.

The systematic study of fuels from all parts of the United States, which was fairly started at the close of the Exposition, has been continued on a more elaborate scale, special attention being given to briquetting slack and refuse coal and also to the use of lignites in gas producers. This work alone gives promise of results which will more than justify the money expended.

It has been found that the efficiency of the average bituminous coal is 2½ times greater when used in a gas producer and engine, than when used in the steam boiler and engine. It has also been found that some lignites, when tested in the gas producer and gas engine, gave unexpectedly high efficiency such as promise large future developments, and further it has been found that some coals and the slack produced in mining these coals can be briquetted on a commercial basis.

These investigations during the Exposition were carried on under the direction of a committee consisting of Dr. Edward W. Parker, Dr. Joseph A. Holmes and Mr. M. R. Campbell, of the United States Geological Survey; the work is now under the direct charge of Dr. Joseph A. Holmes.

The investigation of timber (Prof. W. K. Hatt, Assoc. M. Soc. C. E., in charge) under the direction of Mr. Gifford Pinchot, is limited at present (1) to those species which promise to be on the market for an indefinite period; (2) to actual market products, and (3) to such purely scientific work as forms the basis of correct methods of tests.

The present knowledge of the structural value of the timbers of the United States in the form of large sticks is astonishingly meager. What tests have been made have been made incomplete and defective in many respects. After the present programme is carried out there will exist authoritative and complete information concerning the mechanical properties of the commercial timbers of the United States. One object of the tests is to aid in the framing of definite inspection rules for the various grades of structural timbers.

This work is being carried on in the laboratories located at present at the University of California, Berkeley, Cal.; Purdue University, Lafayette, Ind., and Yale Forest School, New Haven, Conn.

The timber programme also includes tests to determine the effect of artificial seasoning, such as is used in the operations preliminary to the preserving processes, and the effect of the presence of the preservatives themselves; this work is under the direction of Dr. H. Von Schrenk, being a continuance of experiments inaugurated during the Exposition in timber treating and testing.

In order that the money, available for the work outlined above, should be expended in such a way as to secure the most efficient results, it was thought advisable to create an advisory board composed of representatives of the various national societies directly interested, to whom could be referred the scope to be covered by the investigations, the methods to be used, and from whom could be obtained a critical opinion of the results obtained. Accordingly an invitation was extended by the Secretary of the Interior, with the endorsement of the Secretary of Agriculture, to the various national societies requesting their president or some other representative to serve on an advisory board for the investigation of fuels and structural materials.

In response to this invitation a meeting was held in Washington, D. C., on June 3, 1905, in the office of the Director of the United States Geological Survey, at which meeting were present: Dr. Charles B. Dudley, president, American Society for Testing Materials; chief chemist, Pennsylvania R. R., Mr. C. C. Schneider, president, American Society of Civil Engineers; chairman, joint committee on concrete and reinforced concrete; consulting engineer. Mr. George S. Webster, chairman, committee on uniform methods of tests, American Society of Civil Engineers; chief engineer, City of Philadelphia. Mr. Richard L. Humphrey, president, National Association of Cement Users; consulting engineer, Philadelphia. Mr. Robert W. Lesley, representing the Association of American Portland Cement Manufacturers; president, American Cement Co. Mr. F. H. Newell, chief engineer, Reclamation Service, U. S. Geological Survey. Mr. F. A. Burleigh, representing Mr. James K. Taylor, supervising architect. Mr. Gifford Pinchot, chief forester, Forestry Service. Dr. Joseph A. Holmes, fuel expert, representing U. S. Geological Survey. There were also present by invitation: Mr. E. A. Foose, representing Mr. J. E. Muhlfeld, general superintendent of motive power, B. & O. R. R. Mr. E. F. Kenney, representing Mr. Joseph T. Richards, chief engineer, M. of W., Pennsylvania R. R. Mr. A. A. Robinson, engineer of bridges, representing Mr. James Dun, chief engineer, Santa Fe R. R. Mr. D. W. Lum, chief engineer, Southern Ry. Mr. W. C. Cushing, engineer, M. of W., Penna. lines west of Pittsburg. Mr. C. H. Buckingham, representing Mr. J. E. Deems, general superintendent of motive power, N. Y. C. & H. R. R. R. Mr. J. E. Greiner, representing Mr. D. M. Carrothers, chief engineer, B. & O. R. R. Mr. W. L. Hall, of the Forestry Service.

The meeting was called to order by Dr. Joseph A. Holmes, who in the unavoidable absence of the Director of the United States Geological Survey, explained the object and purpose of the meeting. The advisory board organized by the election of Dr. Charles B. Dudley, M. Am. Soc. C. E., president, and Mr. Richard L. Humphrey, M. Am. Soc. C. E., secretary. The scope of the investigation of structural materials for the present year was considered at length, and the programme outlined in The Engineering Record of Aug. 26 was finally adopted.

The following national societies are represented on this advisory board: The American Society for Testing Materials, American Society of Civil Engineers, American Society of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Institute of Architects, American Railway Engineering and Maintenance of Way Association, American Railway Master Mechanics' Association, Association of American Portland Cement Manufacturers, Geological Society of America, National Association of Cement Users, National Board of Fire Underwriters, National Fire Protection Association, National Lumber Manufacturers' Association.

There is also associated with this advisory board a representative from each of the following branches of the Government: Bureau of Yards and Docks, U. S. N.; Corps of Engineers, U. S. A.; Forestry Service, Geological Survey, Isthmian Canal Commission, Reclamation Service, Supervising Architect.

The advisory board is expected to be a continuous one and will supervise what it is hoped will be an exhaustive series of investigations of fuels and structural materials. The board will not only pass on the plan and methods for carrying on the work, but will also pass on the advance results of the tests, and the various branches will thus have the benefit of the advice of the foremost engineers of this country.

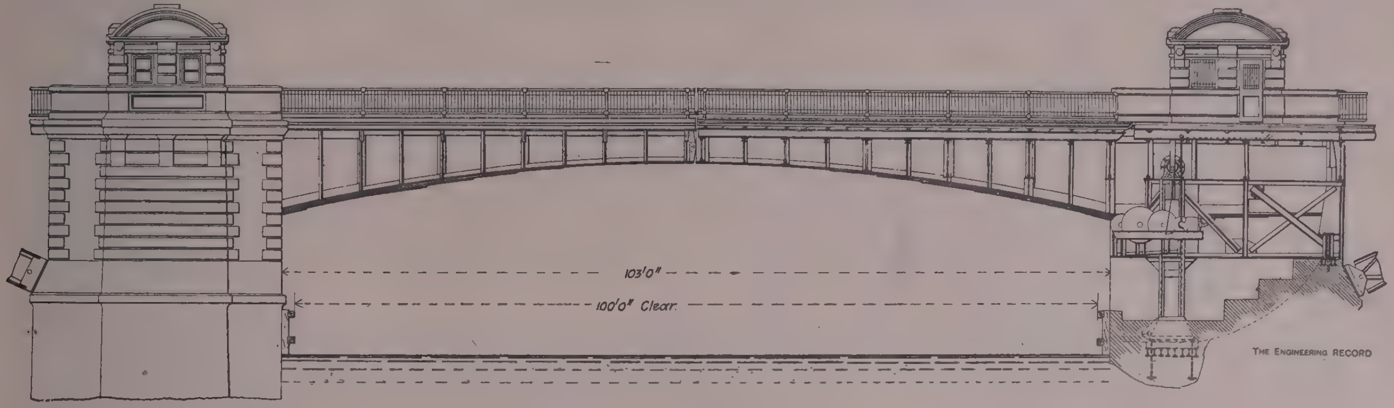
It is the first time in the history of the United States Government that such extensive co-operation has been effected with outside engineers, although the plan has long been in use in European countries. Such close relations between the users of the materials of construction and the branches of the Government engaged in testing such materials it is believed will result in more expeditious and satisfactory work, and will prove of great economic advantage to both public and private interests.

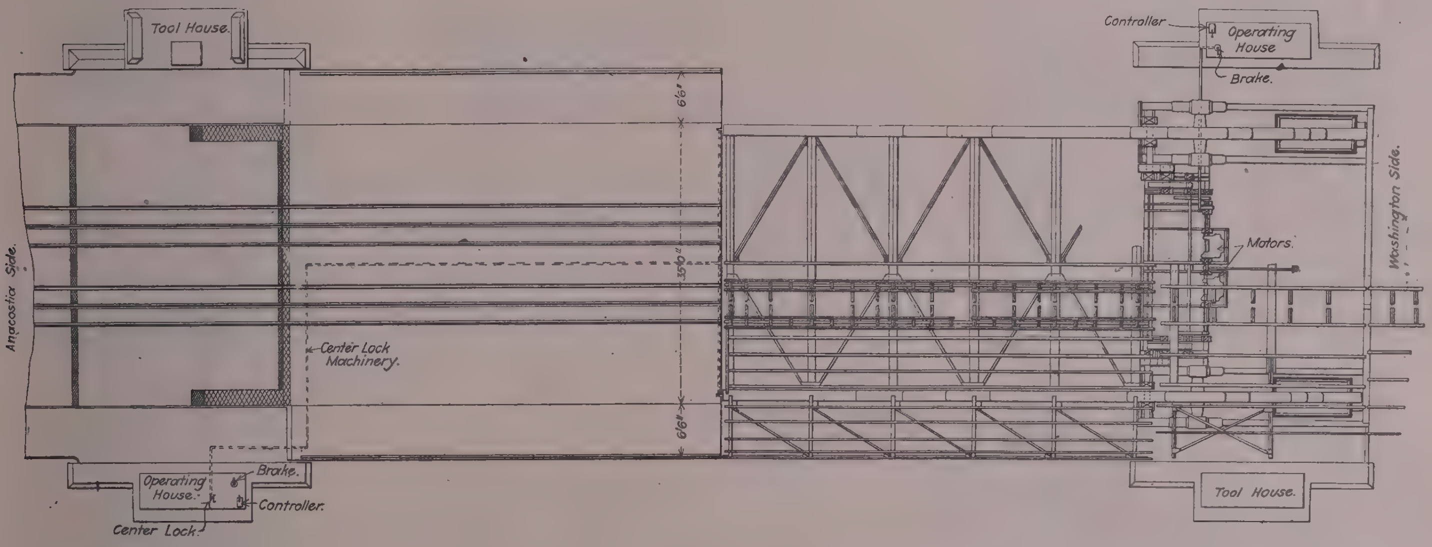
Heretofore such investigations have been conducted by those in the employ of the producer or consumer at such times and under such conditions as would not seriously interfere with routine work. They were, therefore, necessarily incomplete, and lacked the thoroughness desirable. The present investigations will be conducted by a disinterested and wholly impartial party, and possessing the requisite time and money, and the results should, therefore, prove invaluable.

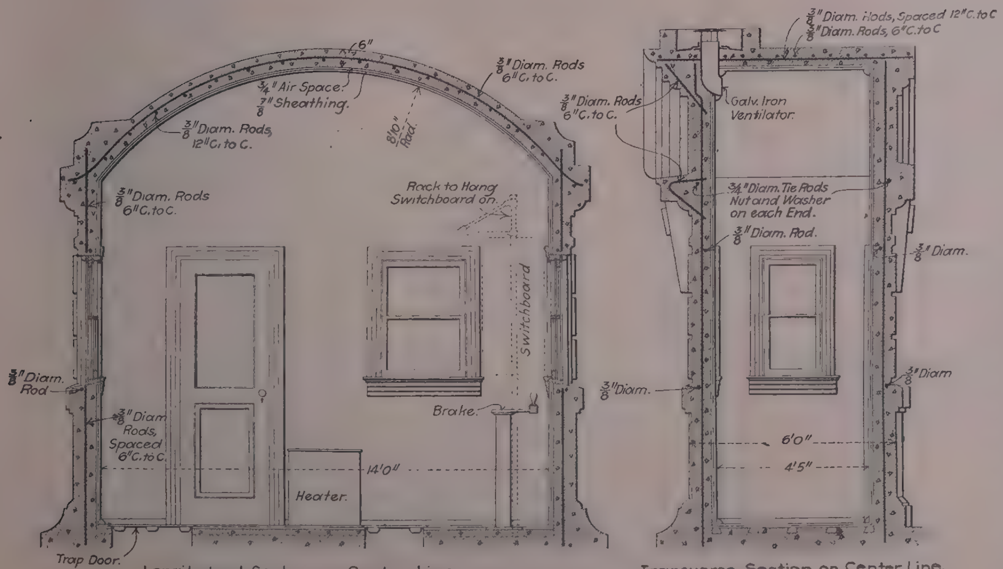
The Anacostia Bridge.—II.

The bascule draw span has a net opening of 100 ft. between fender timbers and a clearance of 24 ft. above low water. The counterbalanced leaves are provided with a locking device at the center of the span and are supported on fulcrum pivots and reaction girders on the piers. In each leaf there is one principal plate-girder cantilever 16½ ft. each side of the axis; they are 80 ft. ½ in. long and 10 ft. deep over all. These are pivoted on 21-in. horizontal axles dividing them into short and long arms of 21 ft. 4½ in. and 58 ft. 8 in. long. They are braced together with deep web-connected plate-girder floorbeams and knee-braces and top and bottom laterals and carry between them the street-car tracks and roadway. The 6½-ft. sidewalks are cantilevered outside the girders with solid web brackets riveted to the vertical web stiffener angles of the main girders and secured to their top flanges with tension splices, as indicated in the elevation of intermediate floorbeams 6, 7 and 8. The flanges of the main girders are reinforced with numerous horizontal cover-plates, as shown in the diagram, and near the pivot have vertical reinforcement plates besides. At the pivot the web is reinforced to a total thickness of 2⅜ in., and to it are secured with twenty-four 1⅝-in. turned bolts a pair of circular flange castings to give extended bearings to the horizontal trunnion shaft on which the girders are pivoted. The trunnion is of forged steel about 8 ft. long, 20½ in. in diameter in the center and 15 in. in diameter on the end bearings and is bored with a 2¾-in. hole through the axis.

At its extremity the web of the short arm is stiffened by vertical and diagonal angles and is enclosed in a rectangular steel plate box 5 ft. wide and 10 ft. long extending the full depth of the girder and containing about 45,000 lb. of cast iron and 2,800 lb. of concrete on each leaf (22,500 and 14,000, respectively per girder) for counterweight. At the end of the short arm the upper corner of the web is notched and horizontal angles are riveted to the lower part to provide a seat engaging the lower flange of the horizontal transverse anchorage reaction girder. Opposite the pivot a segmental rack casting about 12 ft. long with an 8-ft. radius is bolted to the lower flange of the

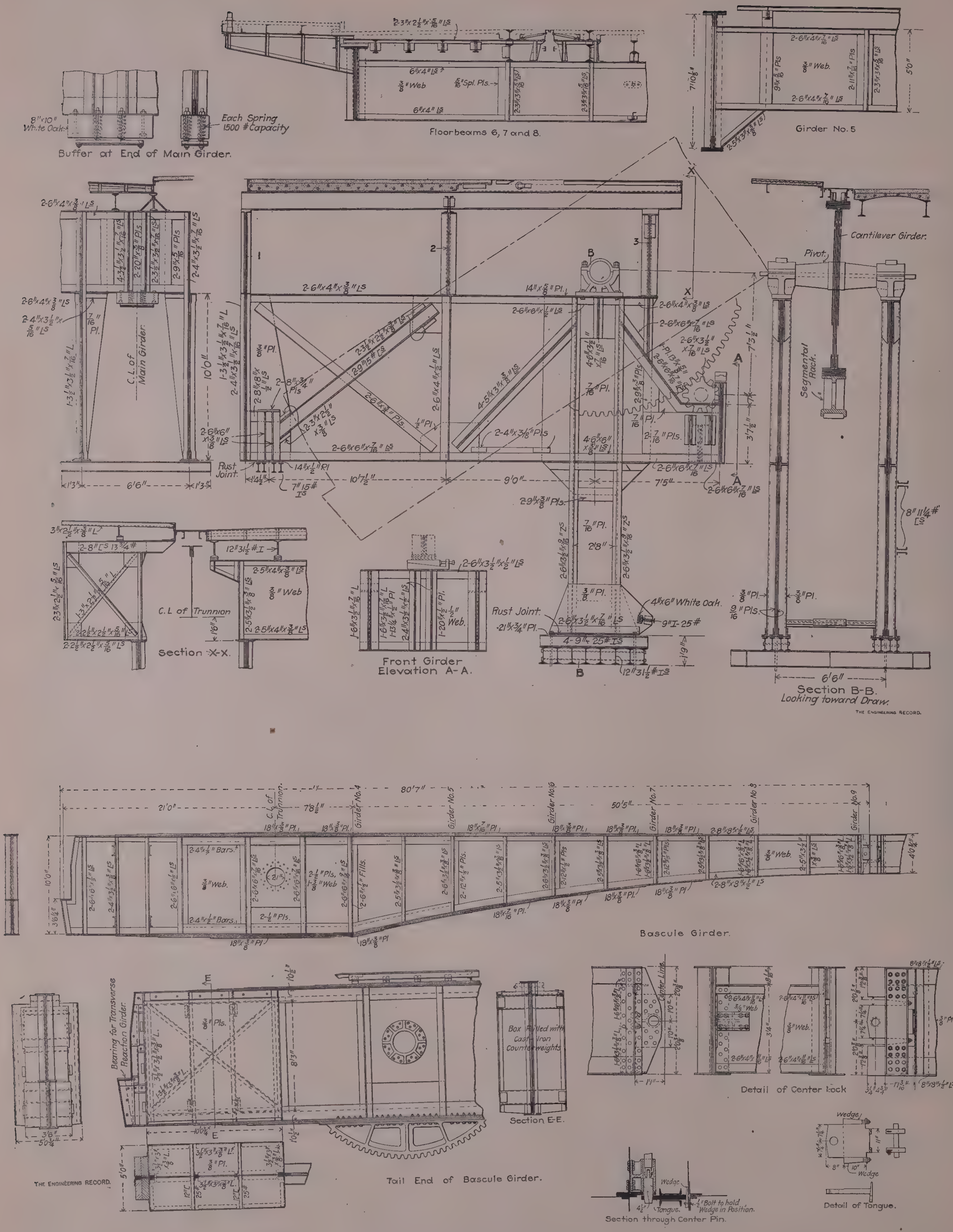





6"
3/4" Air Space.
7/8" Sheathing.
3/8" Diam. Rods 6" C. to C.
3/8" Diam. Rods, 12" C. to C.
8'10" Rad.
3/8" Diam. Rods 6" C. to C.
Rack to Hang Switchboard on.
Switchboard
3/8" Diam. Rod
3/8" Diam Rods, Spaced 6" C. to C.
Brake.
14'0"
Heater.
Trap Door.
3/8" Diam. Rods, Spaced 12" C. to C
3/8" Diam. Rods, 6" C. to C
3/8" Diam. Rods 6" C. to C.
Galv. Iron Ventilator.
3/4" Diam. Tie Rods Nut and Washer on each End.
3/8" Diam. Rod.
3/8" Diam.
3/8" Diam.
3/8" Diam
6'0"
4'5"
THE ENGINEERING RECORD

Longitudinal Section on Center Line. Transverse Section on Center Line.

Plan and Elevation of Bascule Span and Sections of Operating House.



DETAILS OF MAIN BASCULE GIRDERS AND FLOOR.

cantilever girder and engages the 22-in. driving pinion which is located between the supports for the girder, and is geared to a transverse horizontal shaft driven by two General Electric 38-h.p. motors of the railway type.

The motors and operating machinery are set in the walls at each end of the span and are separately controlled from the operating houses above by brake bands and by a controller and resistance. Each pair of motors has a series-parallel controller fitted with interlocking cylinders and pneumatic blow-out. The resistance is so designed that the motors can be brought from standstill to full speed without causing sparking at the commutators or shock or jar to the bridge.

The gear wheels are of cast steel throughout and their cut teeth have involute curves of 15 deg. obliquity with radial line extensions below the involute base circles on the teeth and addendum curves on the large wheel cut inverse with dedendum lines for a twelve-tooth opening. The curves are required to be exact within 1-32 in., and the metal is proportioned for a working stress of 20,000 lb. per square inch.

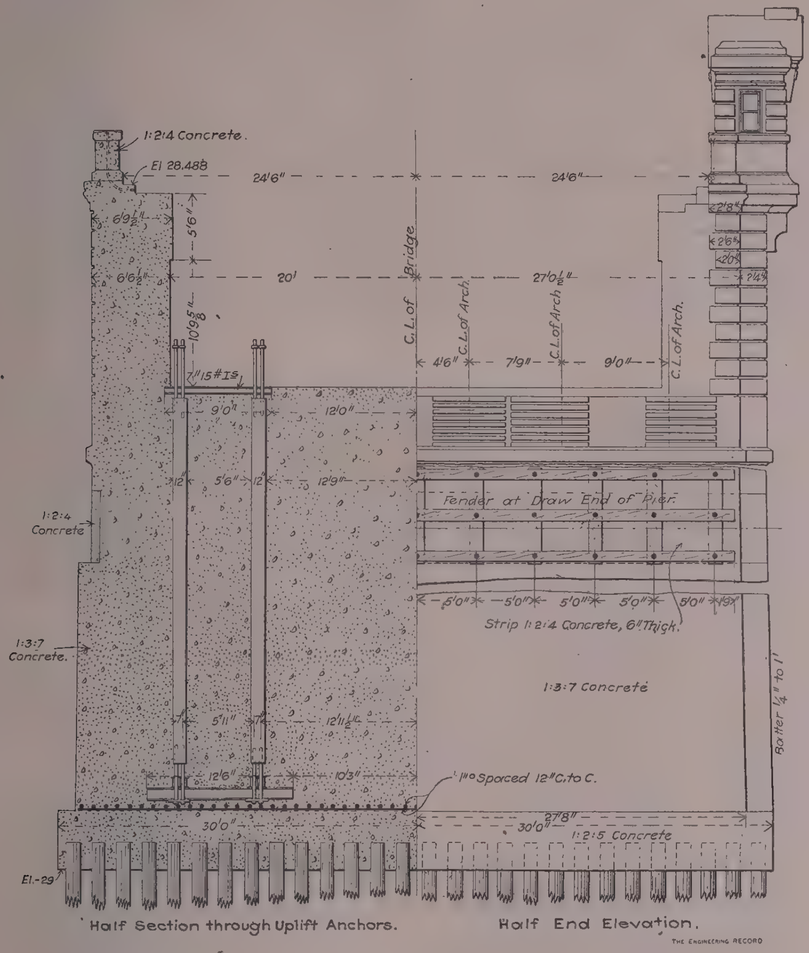
All forgings are annealed and all adjustment bolts have double nuts. The trunnion bearings are provided with compression grease cups designed for a working pressure of 600 lb. per square inch. The motors will be operated by current taken from the 500-volt metallic circuit street railway feeders on the bridge. The machinery is designed to lift the draw within 1 minute under a wind pressure of 12 lb. per square foot of floor surface, acting under the greatest disadvantage, and is strong enough to withstand 25 lb. wind pressure. Hand gear is also provided to capstan heads in the floor for the operation of the bascules.

When the bridge is closed to navigation, as shown in the general elevation, the long arms of the opposite cantilevers are locked together and the girders take bearing between the fulcrums. The extremities of the short arm engage the reaction anchorage girders through spring buffers, as shown in the elevation and detail of the supports for the main girders. The buffers have a vertical movement of about 2 in. and the reaction girders have the ends of their webs spliced to long vertical connection plates, which are integral with the transverse bent enclosing the foot of the cantilever girder. The foot of this bent rests on I-beam sills and is anchored to the reaction grillage built into the bottom of the pier masonry with four 3-in. opposite vertical rods about 38 ft. long. This anchorage is calculated to have a resistance of about 250,000 lb. for the cantilever girder, and to be stressed to a maximum of 66,500 lb. The rods are to be set in narrow collapsible forms and sealed with concrete after the adjustment of the bridge has been completed.

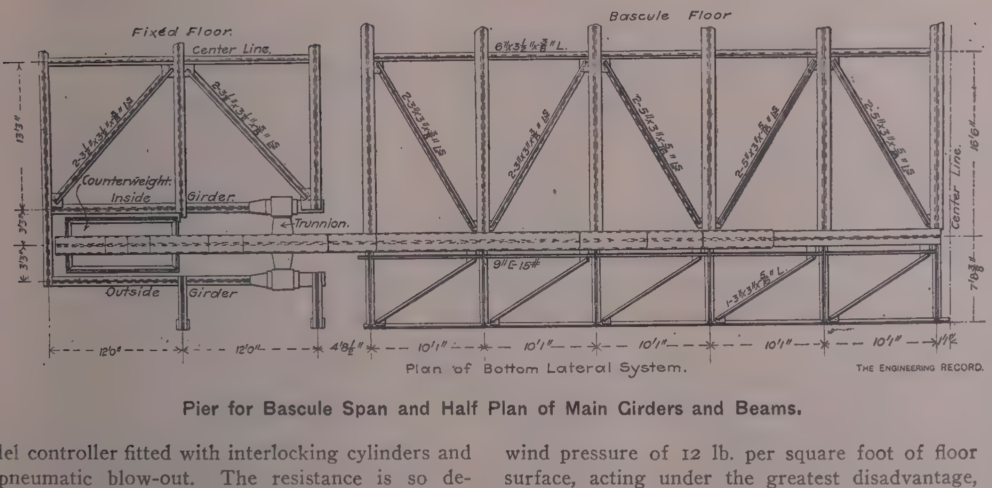
The longitudinal lattice girders connecting the reaction girders and the trunnion posts project 7½ ft. beyond the river side of the latter, where their ends are connected by a transverse plate girder secured to them by ⅞-in. turned bolts, which enable it to be removed if it is necessary to give access to the driving pinion. This girder carries on its upper flange a pair of cast steel wedges, which can be set by an adjustment screw so as to provide bearing for the lower flange of the bascule girder. At the center of the span the adjacent ends of the cantilever girders are locked together when the bridge is closed by a horizontal 4½-in. steel pin, which passes through the overlapping webs of the girders. This pin moves back and forth in a cast steel guide block and is operated by long links commanded by a hand wheel installed in one of the operating houses. The section of the web engaged by the pin in the opposite girder is made adjustable and slides horizontally between vertical channel bars and is locked in position by a system of wedges, shown in the detail.

Special pains have been taken to provide attractive houses on the draw piers. On the east end of the south pier and the west end of the north pier are the operating houses, while opposite each on the other ends of the piers are duplicate houses for the storage of tools, oil, waste, etc. The houses are constructed entirely of reinforced concrete with exterior finish to resemble cut ashlar. They are about 15 ft. long, 6½ ft. wide and 14½ ft. high over all, with an arched roof 6 in. thick, which is reinforced by two layers of ⅜-in. steel rods 12 in. apart. The walls are reinforced by ⅜-in. vertical rods 6 in. apart and by horizontal rods, as shown in the cross-section. The operating houses contain the switchboard, brake, controller and locking gear, and the trap door in the floor gives access to the well in the pier. An electric heater is provided with a capacity to warm the operating house to 70°, with an outside atmosphere of zero. On the roof of each operating house there is a semaphore signal with wooden blade and 32 candle-power electric light, which is operated by hand when the bridge is opened and closed.

In each operating house there is a 1½-in. slate switchboard suspended on rollers and wired so that it may be moved wholly from the wall if necessary. The bridge and machinery have been designed in the office of Mr. W. J. Douglas, engineer of bridges, with Mr. T. Wilson, Jr., in charge of structural work, and Mr. T. C. Bailey, Jr., in charge of masonry work and construction, under the direction of Col. John Biddle, U. S. A., engineer commissioner, and Capt. J. J. Morrow, U. S. A., assistant to engineer commissioner, Washington, D. C. The general contract has been awarded to the Penn Bridge Co., Beaver Falls, Pa., for a total sum of about $340,000, exclusive of approaches.



Half Section through Uplift Anchors. Half End Elevation.



Plan of Bottom Lateral System.

Pier for Bascule Span and Half Plan of Main Girders and Beams.

THE CITY HALL SUBWAY in Philadelphia, the most difficult section of the work in that city, has been let to the E. E. Smith Contracting Co. for $3,000,000. It is an extension of the Market St. line from Fifteenth St. to Juniper St.

Steelwork of the Wanamaker Building, Philadelphia.—I.

The department store building for John Wanamaker, Philadelphia, will occupy a full city block, which was the site of a comparatively low wooden building used by the same owner for the same purposes. This is gradually being removed as the new structure is erected in three sections so that business is now being carried on uninterruptedly while the old store is being replaced by a much taller one of modern fireproof, steel-cage construction which will have an estimated cost of about $9,000,000, and will contain about 28,000 tons of structural steel. The building is bounded by Juniper, Thirteenth, Market and Chestnut streets, is about 476 ft. long, 246½ ft. wide and 278 ft. high from the column bases to the main roof, or about 232 ft. from curb to roof, exclusive of a three-story pent house 50 ft. high on the roof.

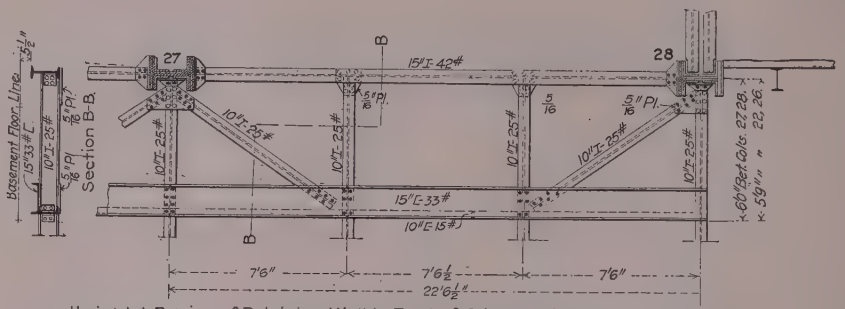
The building is one of the largest of its kind which has ever been erected and its magnitude is indicated by the fact that there are about 40 acres of floor surface and that there will be 69 freight and passenger elevators, besides escalators and large stairways. The apparatus for heating, lighting, steam, electric and hydraulic and pneumatic power, sanitary system, fire protection and other mechanical devices is so bulky and important that it is installed in a special power house several hundred feet distant, and the principal mains and conduits are brought to the store building through a tunnel to the sub-basement. The 66 x 90-ft. four-story power house, which was described in The Engineering Record of July 22 and July 29, has a 5,300-h.-p. battery of steam boilers and corresponding electric installation contains about 1,730 tons of steel, and yet it is only an adjunct of the great store building.

The site was excavated to a uniform depth of about 34 ft. below the curb and pits were dug as much as 15 ft. deeper for the rectangular concrete footings of the columns, which impose a maximum pressure of about 12,000 lb. per square foot on the dry clay, sand and gravel soil. The footings are from 6 to 15 ft. square, and from 1½ to 6 ft. high up to the lower course of the grillage beams. The smaller ones have vertical sides, the larger ones have the sides battered about 1:3 from the grillage beams to 1 ft. above the bottom. The top of each pier is covered with grillage I-beams from 12 to 20 in. deep, with deep I-beams or plate girders across them in the center to receive the extended bases of the columns. All interstices between the beams and girders are filled with concrete and 4-in. of concrete encloses them on all the outer sides. The column bases are 14 in. or more below the sub-basement concrete floor, which is sealed around the columns.

The whole area of the building is enclosed by a concrete retaining wall generally 8 ft. thick at the base. In general, this wall has a vertical outer face, and is battered and offset on the inner face to a thickness of less than 2 ft. at the curb. It helps carry the basement and mezzanine floors of the sidewalk vaults, their floorbeams having their outer ends built into the concrete, and serving as braces against the external thrust, which is transmitted to the steel framework and balanced by that on the opposite side of the building. In some places the old retaining wall was found in good condition and was kept to form the upper part of the wall, being underpinned by new concrete carried down 10 or 15 ft. to the required depth.

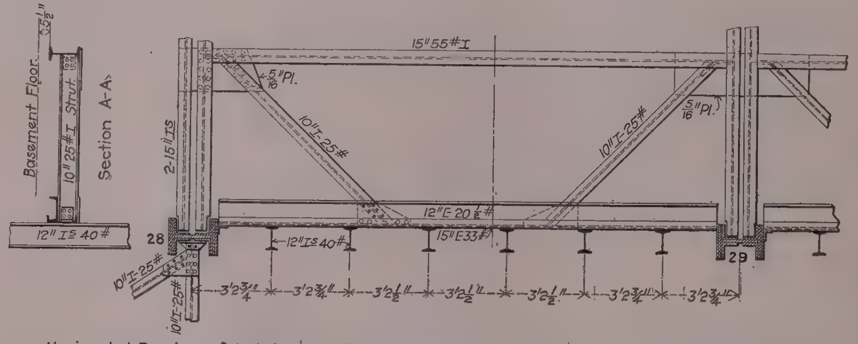
On a part of the Juniper street front the retaining wall is only from 39 to 48 in. thick, and is reinforced by vertical 12-in. I-beams bedded in it about 38 in. apart. In some panels the vertical I-beams are on the center line of the wall columns and their upper ends take bearing against horizontal girders made of a 12-in. and 15-in. channel connected to the columns and trussed by diagonal braces to the intersections of the floor beams and girders, as indicated in the plan showing construction from columns 28 to 33. In adjacent panels the inner face of the retaining wall is 6 ft. beyond the center line of the wall columns, and the wall has no vertical I-beams, but its upper inner face takes bearing on the vertical web of a 10-in. horizontal channel, reinforced by a 15-in. channel with a horizontal web riveted to it to make an unbalanced unsymmetrical T-shape cross section girder, like that above described. This girder is braced by diagonal horizontal struts to the columns and by the transverse floorbeams of the vault basement floor, which project through the wall, as shown in the plan of the retaining wall bracing in panels 22-26 and 27-28.

Between columns 28 and 32 the lower ends of the retaining wall vertical I-beams are web-connected to the horizontal webs of 12-in. horizontal channels, the ends of which are riveted to transverse vertical plates across the webs of the distributing girders on the grillage beams, thus transmitting the wall thrust directly to the foundation grillages. In 72 piers, which have vertical faces, the original design was revised and the concrete was reinforced by a longitudinal and a transverse tier of ¾-in. square steel horizontal bars 6 in. apart 9 in. above the lower surface of the pier.



Horizontal Bracing of Retaining Wall in Front of Columns 22 and 26, 27 and 28 at Basement Floor.

THE ENGINEERING RECORD



Horizontal Bracing of Retaining Wall between Columns 28 to 33 at Basement Floor.

THE ENGINEERING RECORD.

Inside and Outside Forms of Retaining Wall Bracing.

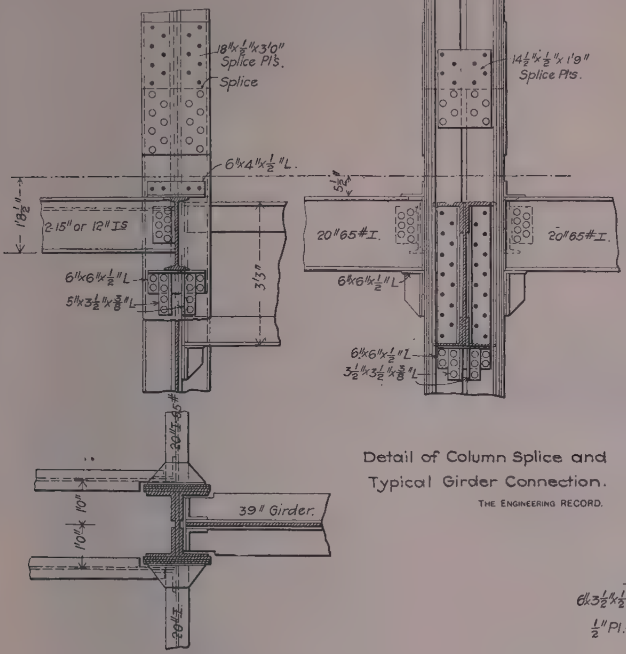
The framework of the building is remarkably simple and regular, and consists merely of the columns, beams and girders in rectangular panels, the principal variations being due to the fire escape towers, the elevator and stair wells. There are 264 main columns located at the intersections of 22 transverse and 12 longitudinal lines parallel with the streets and from 22 to 23 ft. apart. All columns have I-shape cross sections made with a web plate, four flange angles and reinforcing flange and web plates as the stresses require. The web plates are all 13 in. or 17 in. wide, the cover plates 15 in. or 18 in. wide, and the flange angles 5 x 3½-in., 6 x 6-in. or 8 x 8-in. The lightest columns are those in the attic and pent house stories, some of the minimum having a 13 x ⅜-in. web and four 5 x 3½ x ⅜-in. angles. The heaviest sections are in the basement stories of interior columns, which have two 17 x ⅞-in. web plates, four 8 x 8 x 15/-16-in. flange angles and four 18 x 15/16-in. and two 18 x ¾-in. cover plates. This column, No. 22, is proportioned for a total load of 2,400,000 lb., and the longest piece weighs about 24 tons.

The regular columns are each made in seven lengths with splices 20 in. or 22 in. above the finished 1st, 3d, 5th, 7th, 9th and 11th floors. Below the first floor there is a basement, sub-basement and a basement mezzanine story so that the lower tier of columns are about 49 ft. long, and carry three tiers of floor beams and girders. Between the first and third floors there is a second floor and two mezzanine floors, so that those column sections are about 50 ft. long and carry four floors. The next sections are 43 ft. long, and the remainder are all two regular stories or about 35 ft. long.

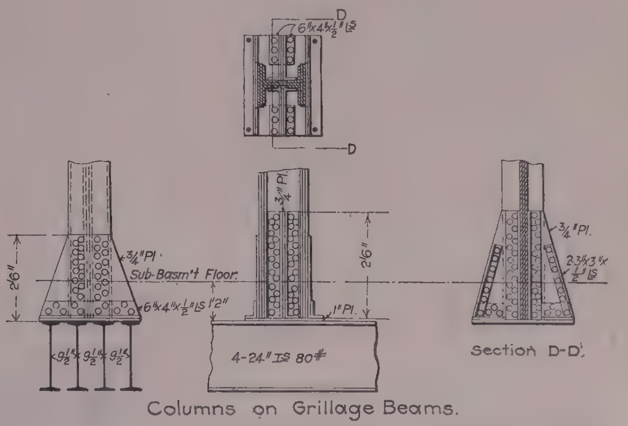
The column bases correspond with those shown with the distributing girders and grillages, and are extended by wide gusset plates riveted to the flanges and by parallel vertical web plates connected to the center line of the column webs, and having their inclined outer edges stiffened by flange angles. The lower edges of all these plates are faced to bearing on the base plate, which is stiffened by them and by their connection angles so as to distribute the column load uniformly over all the transverse pier girders.

The column splices are made with web and flange cover plates shop-riveted to the upper ends of the columns and so as to form double sets of jaws between which the lower ends of the upper sections above are entered and field-riveted. All beams and girders connected to the columns have their lower flanges supported on shelf angles with their horizontal flanges reinforced by the faced upper ends of vertical distribution angles, generally in pairs. In general the floor girders are pairs of transverse 15-in. I-beams to which all of the longitudinal floorbeams are connected, none of them being connected directly to the interior columns.

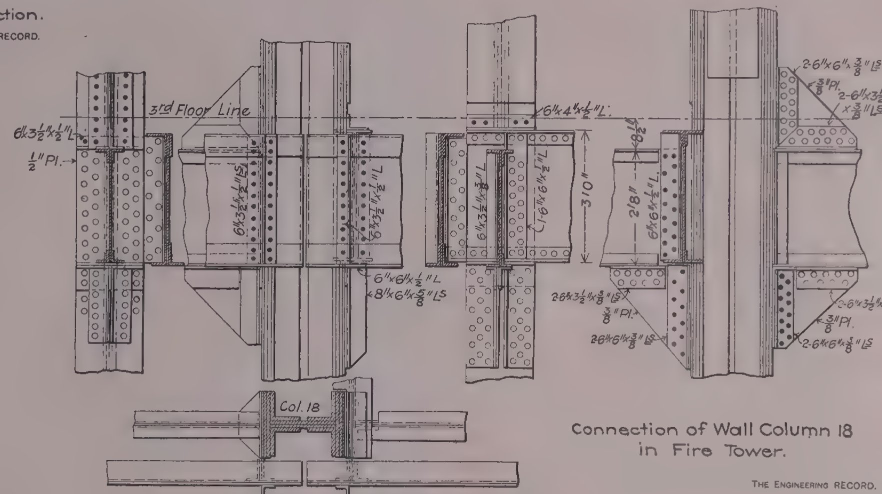
In the typical connection of an interior column the girders are seated on a shelf angle with single vertical distribution angles reinforcing the horizontal flange in the planes of the girder webs. A corresponding horizontal angle is field-riveted across the top flanges of the girders and to the column, but the girders have no web connection with the column. The floor beams are web-connected to the girders close to the column, with single short vertical angles having five field-driven rivets in each flange acting in single shear. The space between the end of the beam and the face of the column is so small that there is not room there for a second web connection angle.



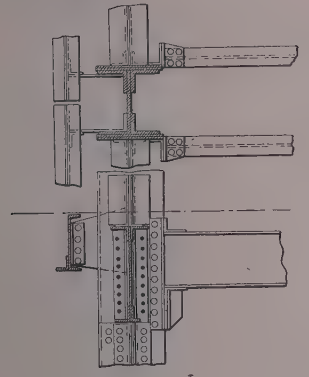
Detail of Column Splice and Typical Girder Connection.
THE ENGINEERING RECORD.

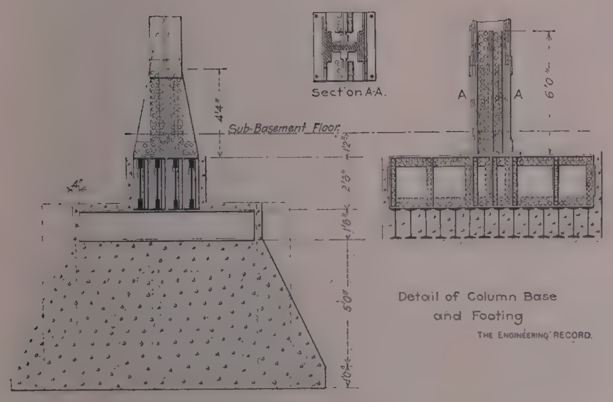


Columns on Grillage Beams.
THE ENGINEERING RECORD.

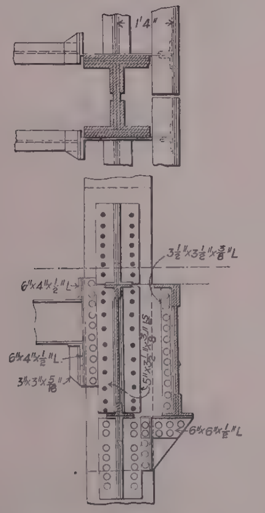


Connection of Wall Column 18 in Fire Tower.
THE ENGINEERING RECORD.

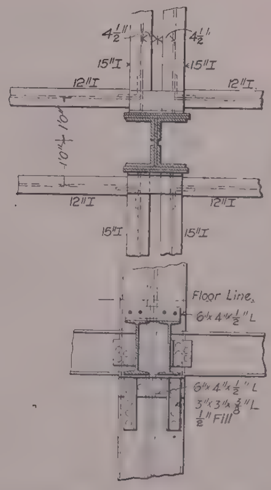

Detail of Spandrel Girder Connection, 4th to 9th Floors Inclusive. On Market and Chestnut Streets
THE ENGINEERING RECORD.



Detail of Column Base and Footing
THE ENGINEERING RECORD.



Intermediate Wall Column.



Typical Beam and Girder Connection to Interior Columns.

Column Details and Girder and Beam Connections.

In the tenth and eleventh stories there are large rectangular open spaces in the center of the floor and the framing around the sides of the well is special. At the corner columns the transverse girders are single 24-in. I-beams, with shelf angle connections, and a 45-in. longitudinal plate girder is web-connected to the column by 28 ⅞-in. field rivets in single rows through 6x6-in. vertical angles. On each of the long fronts of the building about 100 ft. from the center, the beam and girder connections and framing are special to provide for freight elevators, conveyors, dumb waiters, vent and pipe shafts, stairways and a fire escape tower entirely inside the building, which occupies with its stairs and landing, one floor panel in each of the four places. The construction here involves in some places the use of parallel lines of plate girders, which are directly connected to the columns with solid-web kneebrace brackets on top and bottom flanges, but without web connections. The parallel girders are offset 16 in. from the column centers and have their web-plates field-riveted to vertical angles on flange plates which project beyond the column, as shown in the details of wall column 18.

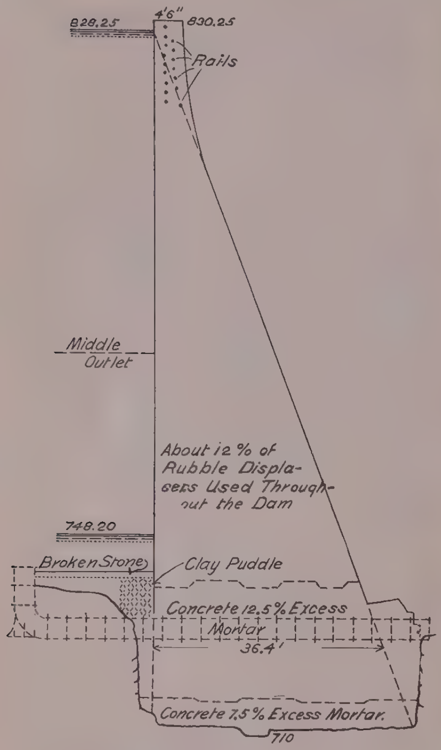
The intermediate wall columns have both web connections and kneebraces for the floor girders and have pairs of solid-web bracket plates projecting from their faces with horizontal shelf angles to carry the wall girders, which are also secured by transverse diaphragm plates riveted to their vertical web-stiffener angles and to the column flange cover plates. The floorbeam connections are made with top and bottom flange horizontal angles riveted to vertical connection angles on the column flanges. On the Market and Chestnut street faces the wall girders from the fourth to the ninth floors inclusive are channels which are web-connected to gusset plates riveted to the insides of the column flange angles. The floor girders have web and kneebrace connections to the columns, as already described, and the floorbeams are connected to the columns through vertical angles riveted to the column flanges to receive the shelf angles, as already described.

D. H. Burnham & Co. are the architects of this building, Mr. J. G. Giaver is the structural engineer, and the Thompson-Starrett Co. (Mr. George Simpson, chief engineer) is the general contractor. The steel work is fabricated at the Pencoyd plant of the American Bridge Co., and is erected by the general contractor.

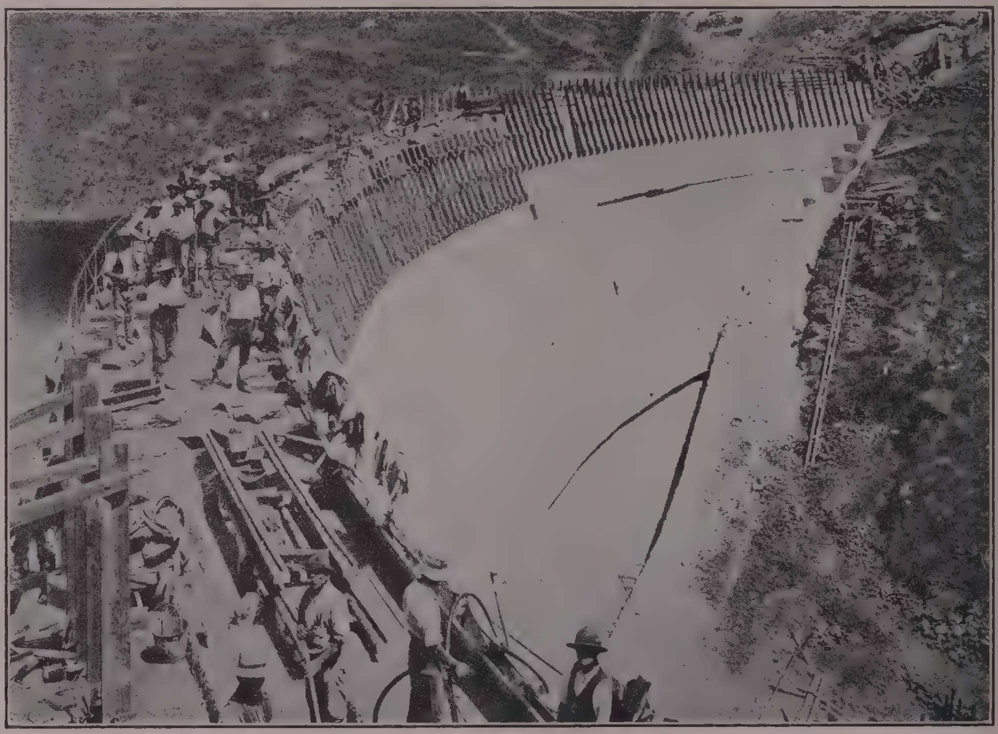
(To be continued.)

The Barossa Arched Concrete Dam.

Now that the U. S. Reclamation Service has undertaken the construction of a number of very high arched concrete dams, the structures of this general type in Australia gain an additional interest for American readers. One of the most interesting is the Barossa dam built under the direction of Mr. Alex. B. Moncrieff, chief engineer of the South Australian government, and from a profusely illustrated memorandum on this work recently contributed by him to the "Transactions" of the Association of Civil Engineers of Cornell University the following notes are taken. It might be stated by way of preface that the dam is used to impound water for the town of Gawler and its vicinity, the surplus above what is required for domestic supply being used for irrigation. The dam is located in a gorge 370 ft. wide at the crest elevation, 94 ft. above the ground line at the bottom. The structure is arched in plan, the radius of the crest being 200 ft. The total length along the crest is 472½ ft.


828.25
4'6"
830.25
Rails
Middle Outlet
About 12 % of Rubble Displacers Used Throughout the Dam
748.20
Broken Stone
Clay Puddle
Concrete 12.5 % Excess Mortar
36.4'
Concrete 7.5 % Excess Mortar.
710

Section of the Barossa Dam.



Progress View of the Barossa Dam Showing Molds.

It was originally proposed to erect a gravity dam at Barossa, but in order to save cost Mr. Moncrieff suggested the use of the arched form, considering the character of rock and the shape of the gorge to warrant him in so doing. The result has been a saving of approximately £40,000. Having determined in the usual way that 15 tons to the square inch left a good margin of safety when applied to the rock at the site of the dam, the particular section as illustrated was developed.

The foundations were carefully excavated, all soft material being removed and the rock seating for the concrete pick-notched throughout.

The composition of the concrete being of primary importance, careful measurements were made to determine the proportion of aggregates and mortar which would give the best result. The first experiments were made with hand-broken stone, the aggregate being 6½ parts stone, 2 parts nuts and 1 part screenings, which grades when combined gave a resultant with 35 per cent. voids. The strength of the mortar proposed was 1½ to 1 with 7½ per cent. of the volume of the aggregate in mortar beyond that required to fill the voids. Upon a trial run with the machine rock-breaking appliances, it was found advisable, in order to avoid waste, to vary the proportions of the aggregate to 4½ parts stone, 2 parts nuts and 1 part screenings, which combination also yielded a mixture with 35 per cent. voids.

After depositing 254 cu. yd. of concrete in the bottom of the foundations, the volume of mortar was increased from 7½ per cent. to 12½ per cent. of the volume of the aggregate in excess of that required to fill the voids in the aggregate. The concrete made with 7½ per cent. excess mortar was found to be of good quality, but contained hardly sufficient mortar to flush properly in 9-in. layers and allow of the insertion of rubble displacers, without much labor and expense in forming a thorough bond with the surface of the large stones.

Further experiments having been made with a view of accurately checking the results previously arrived at, the final results for calculation were as follows: Specific gravity of stone forming aggregate, 2.45; weight of a cubic foot of solid stone, aggregate, 151.121 lb.; voids in various grades of aggregate, 46½ per cent.; weight of a cubic foot of stone, nuts or screenings, 82 lb.; weight of a cubic foot of sand, half from Para River and half from rock breaker, screened through ⅛-in. mesh and washed, 93 lb.; weight of a cubic foot of cement, 77 lb.; weight of a cubic foot of aggregate, 99½ lb.; voids in sand, 40 per cent.; voids in aggregate, 35 per cent.

From the above it will be seen that a slight alteration was made in the voids of the individual ingredients forming the aggregate, viz., 46½ per cent. instead of 45 per cent., as originally given, thus making the weight of a cubic foot of stone 82 pounds, instead of 84.22, as previously stated; also the average weight of a cubic foot of cement was taken at 77 instead of 75¼ lb., as originally, the higher figure being found nearer an average when further consignments were received.

The aggregate is hard, compact, silicious sandstone of the following grades: Stone, screened through 2-in. and caught on 1¼-in. screen; nuts, screened through 1¼-in. and caught on ½-in. screen; screenings, screened through ½-in. and caught on ⅛-in. screen.

The strength of the mortar was fixed as 1½ parts sand to 1 part cement, and, as the voids in

An Arbitration Dispute of an unusual nature was recently settled by the Pennsylvania Supreme Court in Werneberg, Sheehan & Co. v. City of Pittsburg, 59 Atl. Rep. 1000. Where a city contract provided that matters in dispute shall be submitted to the director of public works for his determination, which shall be final, and after the completion of the work a dispute arose which the director heard but did not decide before his subsequent removal from office, after which he refused to act further, the court rules that the clause as to arbitration became void and the matter must be settled in the courts. An arbitration clause like that mentioned and further clauses that measurements should be taken after the completion of the work and that the estimate of the director should be the final measure of compensation to be received by the contractor were held by the court to be consistent, inasmuch as the arbitration clause applied only to any question of dispute between the parties, and the measurement clause applied only to the work performed. It was further decided that under the conditions mentioned, an award by an incumbent of the director's office appointed after the completion of the work and pending arbitration was inadmissable in evidence, owing to the refusal of the first director to arbitrate.

the sand amount to 40 per cent., this practically means that there is a surplus of 40 per cent. of the cement more than necessary to fill those voids. It was also decided that a surplus of mortar of 12½ per cent. of the volume of the aggregate should be used in addition to that required to fill the voids in the aggregate (35 per cent.) in order to insure each stone being thoroughly surrounded with mortar. In the case under consideration the mortar required is 47½ per cent. the volume of the aggregate, which was found by experiment, when increased by 35 per cent. of its own bulk, to give a proportionate volume of cement and sand (dry material) equal to 64.125 per cent. of the volume of the aggregate, and this result expressed in the ratio of 1½ to 1 gives 38.47 sand and 25.65 per cent. cement.

Upon leaving the quarry the rock was conveyed by a gravity cable tramway to an elevated platform, where it was crushed by a Blake rock-crushing machine, and screened through a trommel into bins for the reception of the respective grades. From these it was passed into trucks with a perforated bottom and flooded with water from overhead tanks, and then gravitated by tramway to storage bins at a mixing shed, into which it was tipped. The stone was then run in charges into suitable weighing appliances and tipped direct into a mixer conveying-truck, as required.

About half of the sand required was carted from the South Para River, the balance being yielded by the rock-breaker and the whole of it being passed through a screen of ⅛-in. mesh. The combined sands were thoroughly washed in a vertical cylindrical sand-washer with a capacity of about 2¼ cu. yd. The process of washing was performed by forcing water under a pressure of 70 lb. through perforated pipes in the bottom of the cylinder, and agitating by steam-driven revolving rabbles. Upon completion of the washing the sand and water flowed into a draining trough, through an aperture in the bottom of the cylinder, from which it was removed to the drying floors. When sufficiently dry it was hauled to the storage floor surrounding the mortar mixer.

The cement was received in barrels and stacked in a shed capable of storing about 20,000 bush., to which free access of air was given. Before being used the cement was spread from 9 to 12 in. deep over a wooden aerating floor, immediately above the sand floor, and allowed to remain from 10 to 14 days, being frequently turned during such period. To ascertain if the cement was sufficiently aerated, a small sample was quickly mixed to a plastic condition by the addition of water and a thermometer inserted, and after the initial fluctuation which took place in a few moments had been recorded, if the temperature exceeded 2° in fifteen minutes or 3° in an hour the cement was further aerated.

The cement was allowed to gravitate from the floor above into a revolving mixer, pivoted so as to weigh the correct quantity, which was then re-adjusted by an additional weight and the required quantity of sand added by shoveling. After thoroughly mixing in a dry state, it was automatically tipped into the mixer conveying truck. The quantity necessary to produce half a cubic yard of concrete was mixed in two operations, and these were tipped in layers between the various charges of aggregate to assist thorough incorporation in the concrete mixer.

The aggregate and mortar as described above, and sufficient in quantity to produce ½ cu. yd. of solid concrete, were conveyed to and tipped into the Messent concrete-mixer, and the measured quantity of water, varying between 9 and 14 gal., added. The mixer was then given 14 revolutions, and the concrete was tipped into the drop bottom skip below and afterwards delivered onto the wall by means of the aerial ropeway and carrier.

Tests have been made with a view to ascertaining the crushing strength of the concrete and also the rock of which it was composed. The ultimate average crushing strength of the former at the age of four months was found to be 2.15 tons per square inch, and that of the stone forming the aggregate at 3¾ tons per square inch.

With a view to, if possible, minimize the cost and prevent the usual cracks in the concrete about 15 per cent. of rubble displacers were inserted in the wall. The rock used for this purpose was a gneiss with a specific gravity of 2.67, and the size of the blocks varies between 1 and 18 cu. ft. The stone was measured by displacement before being lowered to the wall, and was then bedded on a layer of cement mortar on the top of the green concrete.

So far the resulting work has proved satisfactory. The dam expands and contracts with the changes of temperature, and there has been no cracking.

Dams for the New Plant of the United Shoe Machinery Co., Beverly, Mass.

Previous to the construction of the buildings of the plant there were two separate contracts let for the grading and excavating of the building site, and for the construction of three dams. One dam was of concrete and fitted with a tide gate to prevent the tide water from backing up beyond the street at the south end of the plant; one was of concrete with a long wasteway channel leading to a lower basin, and a dike 1,000 ft. long, and the third was an earth dam with a concrete core wall and wasteway channel around one end, this dam forming a reservoir holding about 22,000,000 gal. of water for use in connection with the boilers.

The contract for the construction of the dams was awarded to T. Stuart & Sons Co., of Newton, Mass. On the commencement of the work, the contractors decided to construct the lower dam completely before starting work on the other two dams. In this manner, the tide water would be kept out and would not interfere with the work on the middle and upper dams. This plan was carried out, with the exception that the excavation for the wasteway channel connecting the middle and lower basins, involving the removal of some 3,000 cu. yd. of solid rock, was carried on at the same time, the location of this channel being on high ground and not affected by the tide water. This is also true of the wasteway leading around the end of the upper dam.

Lower Dam.—The scheme adopted by the contractors for taking care of the water during the construction of the lower dam included a coffer-dam enclosing the concrete work of the dam, and a 12-ft. flume across the street about 10 ft. east of the coffer dam. By this means the entire dam and embankment, with the exception of the narrow strip opposite the flume was constructed without hindrance from the tide water. After the completion of the dam and embankment, the narrow strip left for a waterway through the embankment was closed up during a low tide.

The cofferdam was constructed by driving a single row of piles in the desired location to rock bottom, which was about 7 or 8 ft. down. On the outside of these piles three rows of walens were securely bolted on, one at the ground level, tween. These walens were made double to give a slot for driving the 3-in. tongue and groove one at high water level, and one half way be-sheet piling. This was done by a floating pile driver fitted with a specially arranged swinging guide for the hammer. The cofferdam consisted of two sides—a retaining wall on the street line, and the west bank of the river forming the other two sides. The ends of this cofferdam were carried well into the street, which consisted of a rock fill, and also well into the west bank. Considerable difficulty was encountered in trying to keep the cofferdam dry, which difficulty was caused by two stone arch culverts under the street leading directly to the center of the proposed dam and tide gate. A considerable time was spent in making these culverts tight by constructing an earth dam with a sheet piling center in the south side of the street.

This cofferdam was braced wholly in an external manner, except diagonal braces at the corners. This outside bracing was done to allow working space inside, and consisted of 1-in. wrought iron rods secured to the dam through the heads of the piles with large nuts and washers, and on the shore, which was ledge, by being looped around bars of 2-in. shafting steel set in holes drilled for same.

Soon after the beginning of the excavation inside of the cofferdam, and during a high tide, when the pressure on the dam was greatest, a pin in the ledge holding one of the bracing rods broke short off at the ground, loosening its hold on the rod which supported 18 or 20 ft. of the north cofferdam wall. The strain put upon the other rods being so great and so sudden, caused some of the rods to part, causing the side of the dam to lean in, and opening up the sheet piling, so that the coffer dam filled in about five minutes. It was thought advisable after this accident to brace the dam entirely on the inside, using 8 x 10-in. timbers spliced together to reach the width of the opening, with 6x8-in. material to tie same together, and uprights to take up the sag and increase the strength of this temporary bracing structure.

This method of bracing being followed out, and with the use of a 6-in. Cameron pump, no further difficulty was experienced in keeping the coffer dam dry.

The excavation for the lower dam consisted mostly of silt and mud with some large boulders, this material being removed from grade 4.0, the original bottom, to grade—4.0, making a hole practically 8 ft. deep with a length of about 87 ft. and a width of 24 ft. to fill with concrete, the top of which was at grade 2.75, and floored over with 3-in. matched spruce.

The material was removed from this hole by two derricks set on the street just south of the lower dam location, and was hauled away in teams and used for filling. The excavation was made to a stiff blue clay bottom, and the concrete base then placed.

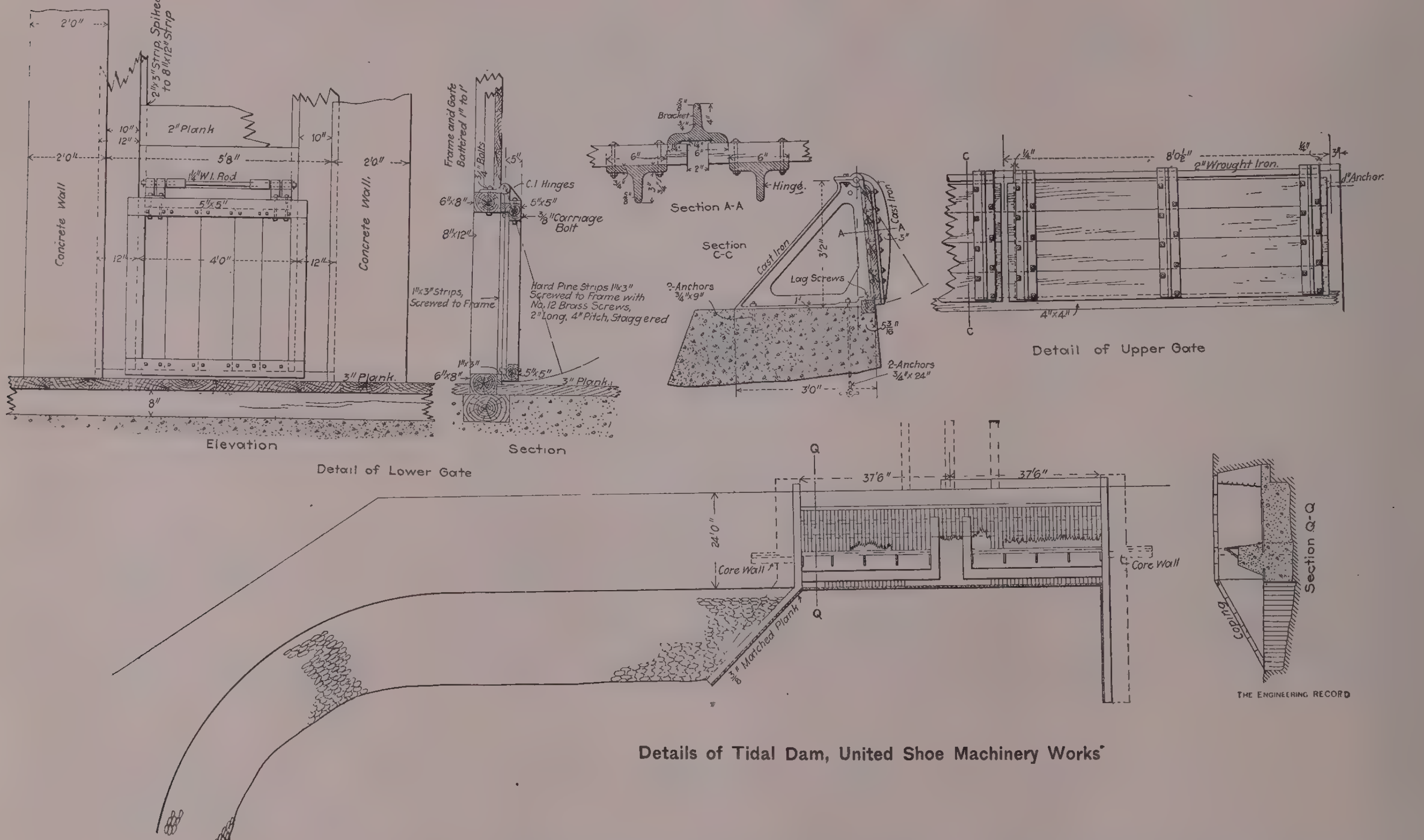
Portland cement was used entirely, and was mixed with crushed stone up to 2½ in. in diameter and good sand to a proportion of 1-3-6. This concrete was placed by the derricks used for excavating, and was carried by dump buckets from the street where it was mixed by hand.

When this block of concrete which composed the base of the dam and floor was poured up to a certain grate, long 6 x 8-in. timbers were set in place parallel with the long axis, and to them the floor of 3-in. matched spruce was spiked. An opening 4 ft. wide and the length of the dam was left without this floor, so that the dam proper would bond with the concrete base. On the completion of this floor the end retaining wall or abutment walls and the main overflow wall were marked out, together with the location of the tide gate and frame which was set in place and temporarily secured in place to the forms for the walls. The sides of the gate frame protruded into the walls 2 in. holding it well in place. Hardwood racks were placed on each side of the tide gate to keep it free from debris.

The forms for the wing walls of the dam were run out and poured at the same time. When finished that part of the embankment inside the cofferdam, which consisted of yellow clay excavated from the building lot, was made by dumping the clay from the retaining wall of the street, and spreading, watering and tamping same.

The construction of that part of the embankment outside of the cofferdam was carried on at the same time that the concrete work of the dam was being done.

The cofferdam was removed as soon as the work inside of same was completed, and the opening in the embankment was filled up during a low tide. The dam blocking up the culverts was removed, and the tide was allowed to run through same to tide gate, which, working properly, excluded all tide water from this point north, leaving the sites of the middle and upper dams practically clear of water for their construction.



Details of Tidal Dam, United Shoe Machinery Works

During the construction of the lower dam, and before the main overflow wall had been poured, the design which called for a concrete wall to grade 12.0 was changed, and flashboards to a height of 3 ft. were substituted for the upper part of the solid concrete wall. This made the overflow wall at grade 9.0, and allowed the fresh water which accumulated in the lower basin to flow off at that height if the tide gate was closed and the tide was at a height below grade 9.0.

Since the completion of this dam, there have been exceedingly high tides, and once, when combined with a thaw, the fresh water rose 6 in. above the top of the flashboards, the water running over them into the tide water which was 18 in. lower. On another occasion during a severe snowstorm, the wind caused the tide to rise to grade 13.0 at this dam, the salt water running over the flashboards a foot deep into the lower basin, which was quickly filled to grade 11.0, the grade of the overflow in the middle dam. It then backed up through the wasteway channel over the middle overflow into the middle basin, which fortunately had been emptied a few days previous. This case was a reversal of the way in which things had been planned.

When the water in the lower basin begins to rise above grade 8.0, it commences to back up through the storm water sewer system, the highest point of which is grade 11.0. This grade being governed by the grade of the roadways which is 14.0. During the construction of the buildings (the grade of the basements of several of which is —5.0), these exceedingly high tides caused the lower basin to fill to grade 11.0 or 12.0, filling these basements. During the winter of 1903-4 the ice wore and broke off the concrete edges of the main overflow wall, also the vertical edges of the gate walls. This was remedied by reinforcing all of the exposed edges with ¼-in. steel angle irons, secured by expansion bolts. This reinforcement or protection for the exposed edges was put on in September, 1904, and the work is in excellent shape at this time.

Middle Dam.—At the time of the completion of the work on the lower dam, the wasteway channel leading from the middle dam and basin was nearly excavated. It was in rock the entire length, and was intended to have a rock bottom, the hollows to be filled in with concrete, and rock side walls. In taking the rock out the seams running across the channel caused the blasts to tear out large pieces of rock from the sides and bottom, leaving unsightly gaps. These gaps were filled in with concrete, and a concrete bottom with a trowelled surface laid, and concrete side walls were also constructed, bringing the wasteway to the grade and width called for on the plans. The rock excavated from this wasteway was crushed on the site of the work and eventually used in the concrete work of the buildings.

After the severe winter of 1903-4 it was found that the frost and water pressure under the concrete floor of the wasteway channel from the middle dam, had caused it to crack and heave. In a number of places where the floor was only 1 in. thick the pressure of the water which had in some manner filtered underneath, had raised the floor and caused it to break into many pieces. The work was repaired in the following manner, during August and September, 1904: All of the loose concrete, and as much more as was necessary to get a satisfactory piece of work, was removed. The floor was then thoroughly cleaned, washed and swept down, and given a coating of cement mixed with a milk of lime mortar mixture. This coat was rubbed in by means of wire brushes. Following this, the floor was covered with a thick paste of the same mortar about ¼ in. in thickness, and immediately after this was applied, a 3-in. thickness of 1 : 1½ : 3 concrete was laid, this being thoroughly rolled in with a wooden roller. On top of all this, and within a few hours, was spread a 1-in. layer of 1—1½ finishing mixture of sand and cement, this being trowelled to an excellent wearing surface.

A tarred paper expansion joint was placed entirely across the floor of the wasteway channel every 30 ft. At low places in the ledge bottom of this floor were placed short pieces of 3-in. wrought-iron pipe stood on end, the tops flush with the finished floor. These holes relieved the pressure from the water underneath. Holes were drilled in the side walls about 6 in. from the floor, these holes relieving the pressure from back of the walls. This floor has now successfully stood the test of ice and snow during the last winter.

The location of the middle dam has been changed from the original location, which was across the river 100 ft. north of the present location. This change was made for three reasons. First, to reduce the cost of the wasteway, which naturally would have been 100 ft. longer; second, to have the overflow wall on a rock foundation; and last of all, to increase the capacity of the middle reservoir. This moving of the dam location necessitated the construction of 100 ft. more of dike on the east, but it did away with the construction of any embankment on the west side, the new location causing the west abutment wall to be constructed well into the bank and in rock. It also saved making the extra fill which would have been necessary south of the dam in its original position. The overflow wall of this dam, and the walls of the wasteway flare are on solid rock 2 to 6 ft. below the floor of the wasteway.

The site of the east and west embankment of this dam was entirely cleared of muck to a depth of 6 to 7 ft., and to a width of 3 to 4 ft. beyond the foot of the slopes, to serve as a base for the slope paving which was afterwards laid to a height of one foot above the overflow wall. This excavation was done with a derrick rigged with a bull wheel, all the material taken out being piled to one side and later spread to grade. This embankment was made from yellow clay excavated from the side of the upper reservoir. The embankment was settled into place by the continual teaming over it.

The excavation for the north and south embankment was done by excavating a trench to solid bottom, one side of which was directly under the top of the slope of the embankment, the other side being about 3 ft. out from the foot of the slope. This embankment was also settled into place by the teaming over it, and has been in place a year at this writing, having been teamed over constantly.

The water from the streams leading into the middle basin was diverted through that part of the embankment between the gate house and the overflow wall until the completion of the concrete work, when it was turned through a 15-in. drain. This middle reservoir can be completely emptied by means of this 15-in. pipe leading to the lower basin. There is also a 12-in. cast iron pipe leading from close to the overflow wall to a gate house located at the junction of the two embankments, from which point it leads to the powerhouse for condenser.

Upper Dam.—The upper dam is an earth dam with a concrete core wall. A channel forming the arc of a circle has been excavated through the earth and rock bank of the shore, and is lined with concrete side walls and floor.

The nature of the site of this dam was the same as of the other two, consisting of muck excavation to a depth of 5 to 6 ft. to solid ground. This excavation was carried entirely across the river, and to a width of some 3 or 4 ft. beyond the foot of the slopes as a footing for the slope paving.

A trench for the base of the concrete core wall was excavated along on the center line of the dam 3 or 4 ft. below the general grade of the bottom excavated to receive the embankment. This core wall ran well into the bank on the north shore, and abutted with the wall of the wasteway on the south shore. The core wall was carried up to an elevation one foot higher than the overflow wall and its upstream face plastered with 1:1½ mortar. The slope paving on the upstream side was planned to be carried up to an elevation 3 ft. above the grade of the overflow, this being afterwards changed to one foot.

That half of the wasteway wall from the dam to the overflow, the overflow itself and part of the wall at the west end of same, were all carried down to a rock bed. This is also true of the first 20 ft. of the southerly end of the core wall.

On the northerly half of the dam has been constructed a gate house of concrete, one wall of which is formed by the core wall. This gate house has a 14-in. cast-iron pipe leading into it at the grade of the bottom of the reservoir, and has two pipes which lead from it; one being a 14-in. pipe which is used to drain the reservoir, the other a 14-in. cast iron pipe leading across the middle reservoir to the condenser in the powerhouse. The water used in this pipe is kept free from debris by means of a screen in the gate house.

The embankment of the upper dam was made by using yellow clay excavated from the north side of basin just west of the dam, the filling being done on each side of the core wall at the same time, keeping the height of the clay the same on each side, thus equalizing the pressure on the sides of the core wall. The continual teaming back and forth over this fill (not only by the teams making the fill at this dam, but by those loaded teams hauling material to the middle embankment) compacted the material well.

On the completion of the embankment, a paved slope was laid on each side of the dam on a base of 6-in. of screened gravel. The remaining part of the slope is loamed and sodded.

That part of the dam in which was located the gate house, was constructed first, and the water turned through the 14-in. pipe and out into the middle basin, after which the remainder of the dam was constructed.

The dams were designed by Dean & Main, mill engineers and architects, of Boston, Mass., and were constructed under the direction of the writer. The work was commenced May 9, 1903, and completed October 1, 1904, and cost approximately $45,000.

Book Notes.

The "Proceedings" of the twelfth National Irrigation Congress, which was held last November at El Paso, make an octavo volume of 442 pages. The general meetings were productive of considerable talk of questionable importance, but the sessions of the sections on Forestry, Irrigation, Engineering, Climatology and Rural Settlement brought out many important papers and good discussions which will be of value to all interested in irrigation work not only in the semi-arid districts of the West but also in humid districts. The fact is now well known that the successful planning of a profitable irrigation enterprise depends on more factors than good engineering. This volume shows very clearly why this is so, and for this reason, if for no other, it is of much value. It can be obtained from A. W. Gifford, secretary of the congress, El Paso, Tex.

The British Fire Prevention Committee has recently published two new "red books" containing reports of tests made at its station. One of these, on a floor system of the National Fireproofing Co. of Pittsburg, is of interest as the first test of American materials. These were placed so as to form the roof of a testing hut in which a temperature of 1,800° to 2,200° Fahr. was maintained for four hours, after which a stream of water was played on the lower surface for five minutes. The system of flooring was the company's well-known combination of semi-porous terra-cotta blocks with steel wire reinforcement. During the test the floor carried a load of 280 lb. per square foot. After the test it was found that the blocks were intact, although the plastering on them was ruined. The second set of tests was made on doors consisting of alternate layers of plank and asbestos board, which were hung so as to expose them to a temperature increasing gradually to 1,500° Fahr. during a period of 60 minutes and then wet with a fire stream for two minutes on the fire side. A door with perfectly plain surfaces resisted fairly well, but a paneled door burned before the expiration of the test.

It is unfortunate that a copy of Prof. Robert Fletcher's "Disposal of Household Wastes at Summer Resorts, Encampments and Farm Houses" was not received earlier in the season. This bulletin is issued for free distribution by the New Hampshire Board of Health, and ought to do a great deal of good in those parts of the country where unsanitary dangers are most serious. The author very properly uses plain words, for they are needed. The diseases that are spread by flies and polluted water from the focus of trouble in the back yard of the average country home are preventable very largely by the exercise of the same degree of intelligence that is possessed by a yellow dog. So long as it is possible to see "cesspools and wells of drinking water hobnobbing in brotherly love," there is bound to be trouble. Professor Fletcher has written some good advice in a very plain way, and a copy of the pamphlet ought to be studied by those who think that the country is more healthy than the city. The disgraceful filth and dangerous surroundings which nominally intelligent people tolerate is a discouraging indication of the lack of any inherent regard for real cleanliness among a large proportion of our population.

In 1902 the Massachusetts Institute of Technology received a gift from an anonymous donor of $5,000 a year for three years for making experiments on sewage disposal and for publishing the results of the work. A site for an experiment station was secured where sewage could be obtained from the principal trunk sewer of the Boston system, and laboratories were fitted up. The first volume of the "Contributions from the Sanitary Research Laboratory," as the reports are called, contains papers by the following authors: C.-E. A. Winslow and E. B. Phelps, "Chemical and Bacterial Composition of the Sewage Discharged into Boston Harbor from the South Metropolitan District"; C.-E. A. Winslow, "Number of Bacteria in Sewage and Sewage Effluents Determined by Plating upon Different Media and by a New Method of Direct Microscopic Enumeration"; E. B. Phelps and F. W. Farrell, "Mode of Action of the Contact Sewer in Sewage Purification"; E. B. Phelps, "Critical Study of the Methods in Current Use for the Determination of Free and Albuminoid Ammonia in Sewage"; E. B. Phelps, "Determination of the Organic Nitrogen in Sewage by the Kjeldahl Process"; C.-E. A. Winslow and G. C. Willcomb, "Test of a Method for the Direct Microscopic Enumeration of Bacteria"; Earle B. Phelps, "The Interpretation of the Analysis of Sewage and the Effluent from a Sewage Filter." It will be noticed that these papers are all of a preliminary nature; Dr. Sedgwick, who is directing the work, states that the next volume will probably contain the results of two years' series of experiments.

CEMENTS, LIMES AND PLASTERS. Their Materials, Manufacture and Properties. By Edwin C. Eckel. New York, John Wiley & Sons; cloth, 8vo., 746 pp., $6.

For a number of years Mr. Eckel has had unusual opportunities to acquire information concerning the cement industry, owing to official positions held by him. While he has not been engaged directly in the manufacture of plaster, lime or cement, he has observed all stages of the work from securing the raw materials to the preparation of the trade literature concerning the finished product, and has inspected plants in many parts of the country. He has also enjoyed the confidence of some works managers, who have furnished him with data not generally given out for publication. From these sources and the published papers on the subject he has brought together a mass of information hitherto inaccessible to most people and, as a whole, of much value. Moreover, in the preface of the book he cautions the reader concerning the transitory stage of many features of the cement industry as conducted today, and thereby points out at the outset the great danger of relying too much on any printed information as an up-to-date exposition on practice. It should also be stated that some of the most important features of cement making, such as kiln practice and the actual manipulation of powdered coal equipment and burners, are very wisely merely sketched broadly, for some of the details are kept secret and would be of no interest outside the producers' circle anyway.

The book is arranged in seven parts and an introduction. The latter is one of the clearest and best statements of the differences between various cement materials that has yet been written. The first part is devoted to plaster, and its arrangement is typical of the other parts as well, beginning with the character and distribution of the raw materials, the chemistry of their burning, the apparatus and methods used in manufacturing plaster, cost of the process, present condition of the industry, character of the finished product, and a bibliography of the subject. Part II is devoted to limes, including the hydrated product and the manufacture of sand-lime brick; Part III to magnesia and oxychloride cements, and Part IV to hydraulic limes, selenitic limes and grappier cements.

Part V is devoted to natural cements, and in the first portion of it the author introduces a new cement formula which has much merit. He calls it the "cementation index," and has derived it from Newberry's "hydraulic index" by adding factors for the percentages of magnesia and iron oxide contained in natural and puzzolan cements. The index is $(2.8\,SiO_2 + 1.1\,Al_2O_3 + 0.7\,Fe_2O_3) \div (CaO + 1.4\,MgO)$, and the author's description of its use reads as follows:

"The cementation index will be used in classifying the various hydraulic products, for it gives information of value concerning them. But it cannot be the sole basis for classification, because the properties of a hydraulic cementing material depend not only on its composition, but also on the conditions of its manufacture. A material having a cementation index of 1.05 might be, for example, a hydraulic lime, a natural cement or a cement of the Portland type, depending chiefly on the temperature at which the raw material was burned. In general, however, the possible variation is by no means so wide as this. A material with a cementation index of 0.40, for example, could under no possible temperature conditions yield anything but a somewhat weak hydraulic lime." For a further discussion of this interesting index the reader is referred to the book itself.

The author does not take much stock in the prediction that the natural cement industry is nearing its end. In his opinion, if more care is taken in the manufacturing processes this material can be made of a uniform and reasonably high strength and still be sold at a profit. This is probably the true view of the matter. Good natural cement has a magnificent record, and if the same care and attention had been devoted to its manufacture that have been spent on Portland cement the engineers of the country would not look upon it today with such suspicion. It is revealing no confidence to say that some well-known makers of both Portland and natural cements are expecting more development in the latter than the former during the next few years.

The fifth part of the book, on Portland cement, is full of so much detail that before it is taken up it would be advisable to read the valuable paper on the cement industry, presented by Mr. Robert W. Lesley before the International Engineering Congress. Without some such introductory account of the processes of manufacture Mr. Eckel's chapters will be likely to leave only a confused jumble of ideas, in spite of their value to those acquainted with the industry. While this part of the book is full of useful data, it lacks perspective, and it is to be hoped that in future editions the author will provide in the preliminary statements a general outline of the different methods of manufacture, without which much that follows is hardly comprehensible to those unacquainted with the subject already. This criticism must not be considered any reflection on what the book contains, but rather on what it does not give. The descriptive data and the technical information in this part are good, and while some manufacturers may consider that the plants illustrated can hardly be considered typical, and the same may be said of the relative prominence given to different apparatus described, this is really a minor detail. The chapters relating to the constitution, setting properties and composition of Portland cement need not be discussed, for Mr. L. C. Sabin's "Cement and Concrete" has so completely filled that field of technical literature that it is now recognized as the standard American authority.

The final portion of the book is a careful discussion of puzzolan cements, under which term come a number of slag cements made in the United States. The subject is a difficult one to treat without arousing needless discussion; all that need be said here is that the author seems to be entirely unprejudiced in his opinions and has brought together from many sources enough information to allow any reader to make up his mind for himself concerning these much-debated materials.

Letters to the Editor.

ELECTRICITY IN CONTRACTING WORKS.

SIR: It is gratifying to observe in recent issues of your publication evidences of some appreciation by contractors of the value of electrically operated equipment. The mere running of a hoist or a dredge by an electric motor is nothing new, for many years ago such methods of operating were adopted abroad. The novelty lies in the fact that the possibilities of the electric wires with which most city streets are now threaded are at last beginning to dawn upon contractors. The portable steam boiler and engine form a most useful equipment which will always have a large field of applicability, but it is difficult to comprehend why it is still employed so extensively in cities, except for the fact that contractors already possess a number of such units and do not care to buy electric plants until they are worn out.

There are two features of this subject which deserve to be mentioned. The first is that in most cities it is much cheaper to operate contractors' plants electrically than by steam, provided the current is bought at meter rates. The steam boiler and engine used for most contracting purposes are very expensive in operation, both for labor and fuel. They are clumsy, moreover, and thus rather troublesome to shift about. On the other hand, the electric apparatus is less expensive in first cost and in current, and much less difficult to operate and move about.

A second feature of the subject is the freedom of the electric equipment from smoke, noise and dirt. There are now in progress in parts of New York works causing an amount of annoyance to people in the neighborhood which the courts would not allow for a moment if they were acquainted with the fact that the nuisances can be abated by substituting electric motors for steam boilers and engines. The probabilities are that before very long public attention will be called to this fact, and contractors will be driven by law to use the apparatus that it is already to their financial advantage to employ.

It has long seemed to me that some of our electric supply companies were rather slow in taking up this field, for if their agents are furnished with the information easily obtainable concerning the current requirements for different classes of work—hoisting, pumping, dredging, etc. —it ought not to take them long to secure a considerable number of good contracts.

Very truly yours,

New York, Aug. 26 H. C. PARSONS.

CONCRETE CAISSONS FOR THE BRUGES BREAKWATER.

SIR: A recent visit to Belgium afforded an opportunity to inspect some concrete work that may interest your readers. The city of Bruges, once famous as a commercial center, gradually lost its influence on account of the inferiority of its facilities for handling seaborne freight. Accordingly a law was passed ten years ago authorizing the construction of a harbor at Zeebrugge on the North Sea and a ship canal 7½ miles long connecting this harbor with Bruges. The work of construction was undertaken by Messrs. L. Coiseau and J. Cousin, and is progressing rapidly.

Its most interesting feature is the use of concrete caissons for a part of the breakwater. The latter is a curved structure 8,190 ft. long, consisting of three entirely different portions. The shore end, about 775 ft. long, has on the sea side a heavy masonry wall about 10 ft. thick, which supports the earth embankment, 36 ft. wide on top, which forms the inner or harbor part of the structure. At the end of this section is a 984-ft. length of open steel trestle, which is used here to enable the tidal currents to keep the harbor from silting. The third section is the breakwater proper, consisting of two portions, one a great curved dockwall with storage sheds, railways, cranes and all the other facilities needed on piers with depths of water of 26 to 38 ft. at low water; and the extreme outer breakwater, 1260 ft. long, which is a concrete structure rising nearly 44 ft. above low water.

The lower portions of the concrete walls consist of enormous caissons of concrete, which were made in the harbor at Bruges and are towed through the canal to Zeebrugge as needed. There they are floated into place and filled with concrete. They are of different sizes, according to their location in the breakwater. For the wall on the ocean side of the quay section they are 82 ft. long, 24½ to 29½ ft. wide and 28 to 31 ft. high, weighing 1,500 to 1,600 tons. On the pier side breakwater some of the caissons are 101 ft. long, 34½ ft. wide and 42½ ft. high. All of them are divided into three compartments by transverse walls of concrete. They consist of a light steel shell with steel bracing, which acts as an outer protection and reinforcement for the 1:3:6 concrete walls and bottom.

The caisson is put into place at the slack of the flood tide and then sunk by admitting water to all three compartments. Three tugs, a couple of winches on the caisson last put in place, and 55-ton concrete guide blocks of a conical shape dropped alongside the correct location, are used in landing the caisson. As soon as it is grounded correctly, which requires about 10 minutes, concrete is brought up in 13-yd. batches by a Titan crane and dumped into the compartments, filling them in 30 to 36 hours. A caisson of the largest size is thus changed into a 5,100-yd. block of concrete in a much shorter time than the same quantity of concrete could be put in place in such an exposed situation in any other way. It should be added that as soon as the caisson is grounded, large stones are dumped along its sea side to prevent scouring, or mattresses are sunk like those used on the Mississippi River improvements.

Very truly yours,

London, Aug. 7. C. R. WOODBRIDGE.

MUNICIPAL OWNERSHIP has obtained a fine start in the little German city of Freiburg. It has built about 400 cottages for workmen, runs an electric street railway, owns fifty billboards and controls the local outdoor advertising, runs all the pawnshops and the only savings bank in town, owns the local theater, operates a number of public restaurants, conducts the undertaking business, manages a number of farms and forests, and operates a central lighting and power station.

CURRENT NEWS SUPPLEMENT

SEPTEMBER 2, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers, Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Boston, Sept. 25-29.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

THE WILLANS-PARSONS STEAM TURBINE.

About two years ago Willans & Robinson, Ltd., of Rugby, England, manufacturers of the well-known high-speed engine, decided to take up the manufacture of steam turbines. After a careful survey of the work being done in the direction of building turbines of different types, they decided that the parallel-flow turbine, on the system proposed and developed by C. A. Parsons, had stood the test of time and was in a position for manufacture on a large scale. Negotiations were entered into with Mr. Parsons and a license to manufacture under his patents was taken. Consequently the Willans-Parsons turbine is identical in principle and in its main features with the Parsons standard type, and it is only in details of design and manufacture that there are any differences. As, however, these alterations have been introduced with a view to lending greater flexibility to the turbine when in use and facilitating manufacture on the interchangeable system, a few remarks on the subject may be of interest.

Special attention has been given to the arrangement of necessary details, such as governor gear, oil pump, steam and water piping, etc., as it has been found that ability to inspect the working portion of a turbine without dismantling any attendant gear is a convenience appreciated by those who have to take charge of the running and maintenance of machinery. To enable this to be attained, all the gearing and fittings named above are mounted on the bottom half of the bearing pedestals, and the top cover of the turbine, as well as the bearing caps of the three main bearings, are left free for instant removal. To facilitate further the opening of the turbine, the top half of the casing has been arranged with two hinges, thus avoiding the use of guide studs and placing the turbine cover in a suitable position for examination. In the case of the 1,000-kw. Willans-Parsons turbine, it is possible for two men to remove the main bearing caps and to open up the turbine for inspection in less than an hour.

By a rearrangement of the balancing passages it has been found possible to shorten somewhat the length of the ordinary parallel-flow turbine, and, further, due to Fullagar's system of balancing, it has been found possible to dispense with the large balance piston at the high-pressure end of the turbine and to substitute in its place one of considerably smaller dimensions at the low-pressure end. It has been found in practice that this method of arranging the balancing pistons has the advantage of enabling castings of a more symmetrical form to be adopted, and in this way many of the troubles brought about by unequal expansion of the different parts are avoided.

An improved method of attaching the blades to the rotor and casing has been adopted in this turbine. Extraordinary stiffness and rigidity is given to the blade rings when they have been fitted into their respective body or shaft grooves. In the ordinary turbine of this type, each blade is fixed separately into the rotor and casing by means of its own caulking piece. In the Willans-Parsons steam turbine, the blades for one complete ring are built up on two half rings, which rings have had the necessary grooves for receiving the blades cut in them by means of automatic machinery. These complete half rings of blades are then caulked into the shaft or the casing. Attention might be drawn to the fact that the cutting and assembling of the blading by means of specially designed automatic machinery insures that the whole of the blade angles and openings on which the efficiency depends are mathematically correct.

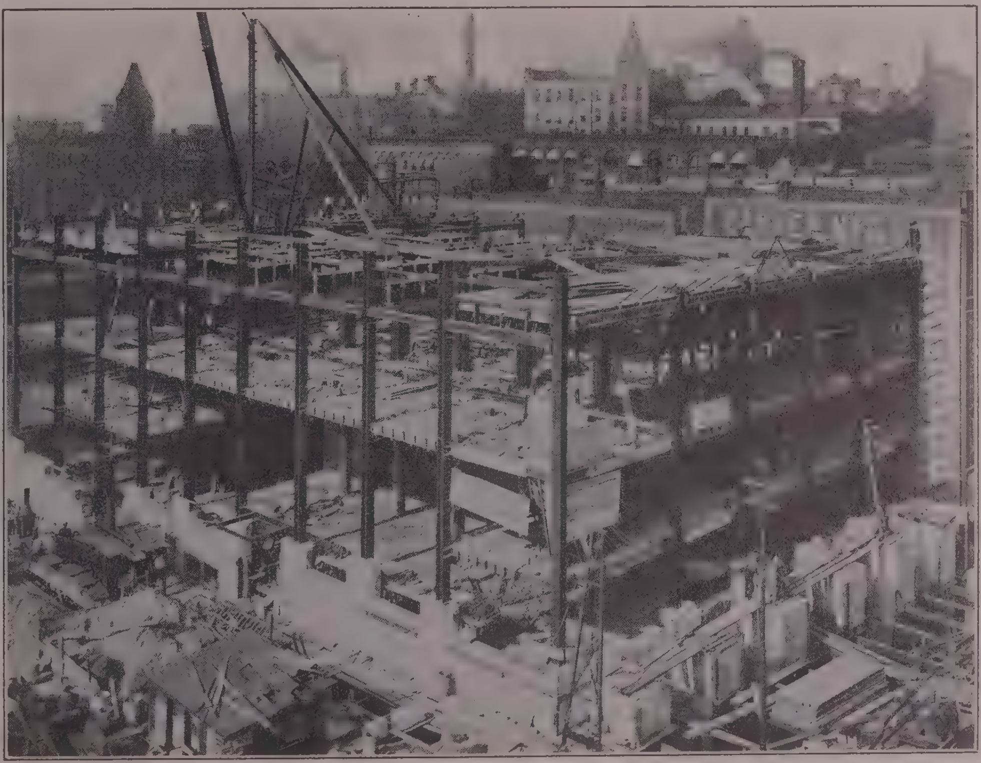
Another feature of the Willans-Parsons turbine consists in the special channel schrouding encircling the blades which this manufacturer has the right to use under the patent of H. F. Fullager. This shrouding is fixed on the half ring of blades before assembly of the shaft or in the casing, and has several points of merit. It adds materially to the mechanical strength of the blades themselves and removes any danger of the blades stripping should the rotor come into contact with the casing, or the blading on the casing come into contact with the revolving shaft. Further, the action of the channel shrouding when under working conditions minimizes the loss due to leakage over the revolving or fixed rows of blades, and by this means a considerable gain in the steam economy is effected.

Special attention has been paid to the question of governor gear with a view of making it as simple and as reliable as possible. By dispensing with some of the intermediate gears hitherto used on governors controlling steam turbines, it has been found possible to eliminate many of the undesirable features and to obtain results in the direction of close governing which it is believed surpass anything hitherto obtainable. All the turbines are fitted with by-pass valves, which automatically open when the maximum economical output of the turbine is exceeded, and by means of these by-pass valves any required overload can be obtained up to the full capacity of the generator, the steam economy of the turbine being, of course, reduced.

At the present time this company has 24,250 kw. of this type of turbine at work or nearing completion, the smallest at the present time being of 750 kw. normal capacity and the largest of 5,000 kw. normal capacity.

AN IMPROVEMENT IN CONSTRUCTING CONCRETE FIREPROOFING.

The accompanying illustrations of views taken during the construction of the First National Bank Building, Kansas City, Mo., Messrs. Wilder & Wight, architects, give a good idea of one of the best buildings of its type in the country. The structure as now completed will be used almost exclusively by the bank, though the entire third floor and rear of the second will be used for offices. The building is planned for an eleven-story office structure, 141.7 ft. on Baltimore Ave. and 90.72 ft. facing on Tenth St., and 215 ft. high to the cornice. For the present it is stopped at the third floor with a temporary roof.


GENERAL VIEW OF THE FIRST NATIONAL BANK BUILDING, KANSAS CITY.

The style of architecture is Roman. The front presents a row of six detached Ionic columns, 4 ft. in diameter and 34 ft. high, extending from just above the main to the third floor.

The foundation is solid rock which breaks out at the basement level. The footings between the rock and brick courses on the walls and column bases of the piers are of concrete. The exterior walls of the entire building to the parapet from the sidewalk level on Baltimore Ave. and from the basement level on Tenth St. are of selected Georgia white marble. This marble, as well as the enamel brick and stone sills, is laid in Puzzolan cement mortar, mixed one part cement to three lime mortar. All brick backing within 2 ft. of the marble was laid in the same cement.

The walls up to the sidewalk line are of Buffalo, Kan., gas brick, laid in Portland cement mortar, mixed one to three. These brick in a test averaged 160 tons per square foot before showing any sign of fracture. Above the sidewalk line the brick are laid in Fort Scott natural cement, mixed one to two.

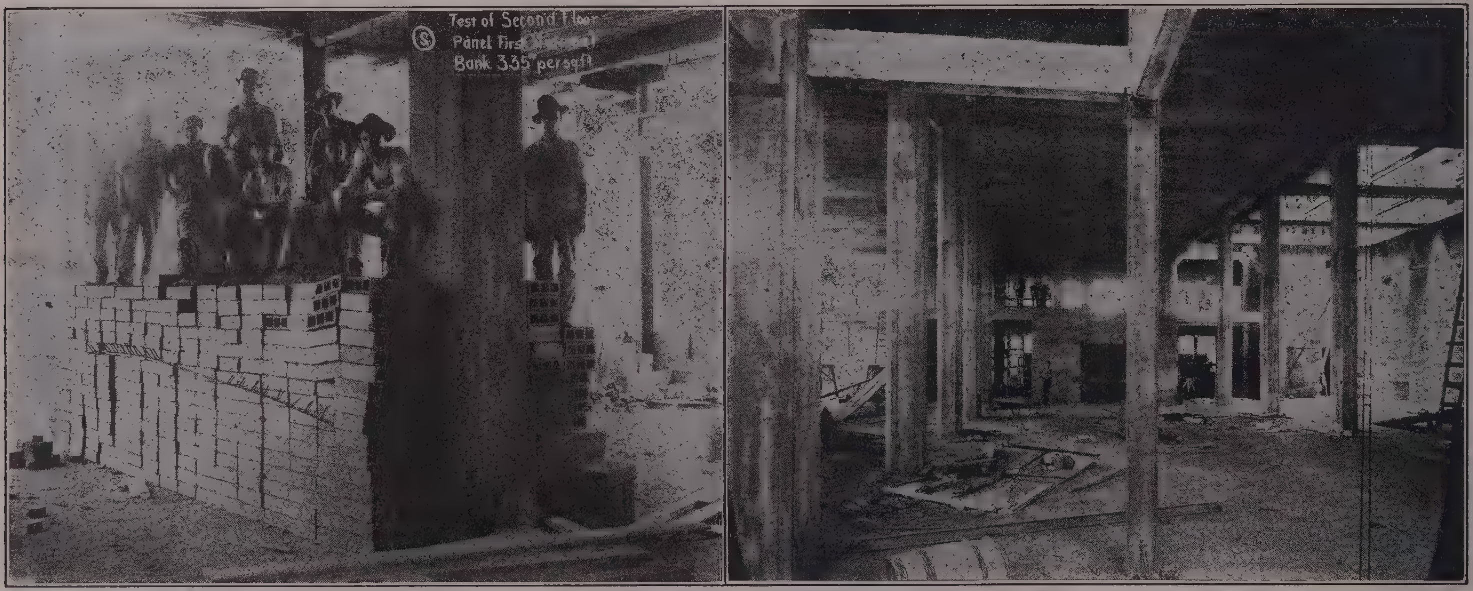
The decorations of the colonnade, lobby, corridors and banking room proper are elaborate in the extreme, and the plumbing and electric fittings are of the best modern construction. Every device to secure facility and safety in conducting the business of the bank has been incorporated, even to the installation of a complete pneumatic tube system.

The heating, ventilating and cooling are entirely controlled by the fan system. The fresh air is drawn into the building through a passage in the upper part of the light area. It is purified, heated and saturated to the proper degree of humidity and then discharged into the rooms, the exhaust leading into the area between the cast-iron segmental smokestack and its brick walls. In summer this process is changed by refrigerating the air to the desired temperature instead of heating it.

From an engineering standpoint, the steel frame with its fireproofing affords some items of interest. The lessons of the Baltimore fire have, in this case, been observed and heeded, and the architects have left no part of the steel construction unprotected. The steel skeleton, with the stairways and stack, weighs 630 tons. The columns are all covered with a cement grout, mixed one to four and 2½ in. thick at its thinnest point. The beams have "haunches" and the lower part is covered with a 1:3 cement grout. The balance of the haunch, as well as the entire floor, is made up of a concrete mixed one, two and four, with an aggregate of Joplin flint broken to pass through a ¾-in. ring.

All the reinforcing, including floors, cash vault, basement, stairs and sidewalk, is of the Kahn system, the bars being spaced from 9 in. to 16 in., depending on the size and load required on the panel. Tests were made upon panels on the first floor, where brick were placed on the reinforced portion to the extent of 350 lb., where but 300 lb. per square foot was required. A section on the third floor was similarly loaded. In both cases the concrete had been down thirty days and the deflection was 3-16 in. on a 14-ft. panel in one case, and the same on an 18-ft. panel in the other.

The contractor, as a precaution, wrapped all beams and columns with wire netting. About 1,000 cu. yd. of reinforced concrete was used, requiring 1,500 bbls. A A Chicago cement and 85,000 lb. Kahn steel.



INTERIOR VIEWS OF THE FIRST NATIONAL BANK BUILDING AT KANSAS CITY.

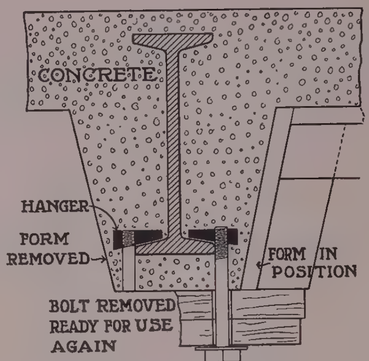
The frames and sashes of all windows are 20-gauge copper. The double doors of the bank, both front and side, are beautiful works of art in bronze, and are 7 ft. 5 in. by 13 ft. 2 in. in height. The fans, elevators and pumps are run by independent motors.

The reinforced concrete work was done by Messrs. Pringle, Campbell & Pringle, and the Kahn steel reinforcement was superintended by Cudworth, Axtell & Co., engineers, who are their local agents in Kansas City. Master carvers have worked upon some of the marble details for months, and this work, together with the exterior marble work, was done by A. Sutermeister.

The estimated cost of the finished structure is $300,000. The architects were ably seconded by the general contractors, Messrs. George L. Brown & Son, in their desire to turn out a first-class piece of work, and the general contractors, beside carefully selecting all the material specified for the building, have kept an engineer upon the work the entire time.

The most interesting thing about this building is the fact that Messrs. Brown's engineer, Mr. James H. Dousman, has discovered a decidedly important improvement in the method of conducting concrete work like that employed in this structure. He kept a detailed cost account of all expenses incident to the erection of the building, and very soon discovered that one of the heaviest was the cost of labor and materials for the forms. As all these expenses are necessarily charged to the "loss" account," he determined to reduce them to the minimum.

The first step in taking down the forms commonly used in fireproofing is to take off the nuts of the bent hanger bolt. This is done in pairs by two men working on a scaffold, and when a section of six or eight nuts has been removed the form is taken down. The average time of the two men is about 20 minutes to the section, including the time spent in moving the scaffold. When the forms are all down and the overhead pieces out of the way, two other men on the scaffold cut off the bolts with handsaws, close to the concrete or tile. This work costs about 2 cents per bolt, and, of course, leaves the bolt worthless.



THE DOUSMAN HANGER.

The improvement devised by Mr. Dousman is shown in the accompanying illustration. The only labor required in removing the forms is to unscrew the hanger bolts, which is easily done if they are well greased with a heavy lubricant before use. The girders are left smooth ready for plaster, the bolts are available for use again, and the hanger heads on the flange of the beam are in place for carrying a suspended ceiling, a steam line or a sprinkler system. A pair of these heads will carry an overhead trolley rail for pretty heavy loads. Consequently this improvement not only saves about 40 per cent. of the cost of handling forms, but also is of much assistance in the subsequent work on the ceiling. This is particularly important when the destruction often done to fireproofing in putting up decorations and piping is borne in mind. Mr. Dousman, whose address is 3121 Michigan Ave., Kansas City, has applied for a patent on these hangers.

A NEW STEAM PACKING.

The troubles incident to the use of packing in mains carrying high pressure of superheated steam have brought about the common practice of making up such joints with machined flanges. It is a more expensive way, but has heretofore been considered the most economical in the long run. Recently there has been placed on the market what is known as the I X L steam packing, which is claimed to have unusual powers of resisting the action of superheated steam, acids, oils, ammonia or alkaline liquids. It seems to be particularly appropriate. The packing is easily applied, and is claimed to give absolutely tight joints for the highest pressures. The makers recommend it particularly for use in the packing of cylinder heads and steam chests, as well as piping, as it will not be pressed out or blown out from between the flanges. If properly applied at first it should not be necessary to tighten the bolts of the flanges afterward. It is believed to be the first non-metallic packing capable of withstanding a pressure as high as 15 atmospheres or a temperature as high as 900° F. Moreover, it can be used with rough or unmachined flanges. It is made in all thicknesses, and is light in weight for a given surface. The 1/16-in. thickness weighs only 5 lb. to the square yard. The packing is made by the I X L Steam Packing Mfg. Co., and the selling agents are Frederick Vietor & Achelis, New York City.

WATERPROOFING WITHOUT HEAT.

During the construction of the Subway in New York the desirability of some method of waterproofing that could be applied to cold, damp surfaces became evident. Mr. Herbert Paschke studied the subject for several years and finally perfected the Carboron cold waterproofing system. Two materials are used, one a bituminized fabric and the other a sort of paint, which are applied in successive layers to the surface to be treated. The fabric is preferably muslin for most purposes, although burlap, canvas or other material can be used. This is saturated and slightly coated with an asphaltum compound at the factory. The paint is called an "amalgamating solution" and is a compound of asphaltum with a highly volatile mineral oil.

The surface to be waterproofed is covered with a single thickness of the prepared fabric. This is then painted with the solution, another course of fabric put in place, and the process continued until the desired thickness of waterproofing materials has been obtained. The solution does not act as a cement, but by the evaporation of the volatile oil, becomes a part of the waterproofing material of the fabric.

The special features claimed for this system are its availability for damp and cold surfaces and freedom from any heating of materials or surfaces during the work. Wet concrete can be placed directly against the Carboron course, and, it is stated, will have a very tenacious bond with it. Skilled labor is said to be unnecessary in the use of these materials.

An example of the structures on which this system has been used is an ejector pit on the New York Subway at 116th St. and Lenox Ave. The bottom of this pit was about 12 ft. below the ground water surface and some 7 ft. below mean low tide. The pit was excavated in a free-running sand heavily charged with water, courses of the material being practically a quicksand. The outer shell consisted of steel sheet piling lined with concrete and the bottom of the pit was covered with reinforced concrete. There was a large amount of leakage through the concrete, yet the waterproofing was applied expeditiously and successfully.

This system of waterproofing has recently been taken up commercially by the Sicilian Asphalt Paving Co., New York.

THE WEST SHORE ELECTRIC CONTRACTS.

Contracts have been awarded for the electrical equipment of the West Shore Railroad from Utica to Syracuse. This is in line with the plans of the Andrews-Vanderbilt New York Central interests for interurban electric service across New York State. Contracts were placed with the General Electric Co. for motor equipments and sub-station apparatus. The placing of the latter contracts settles the much-vexed question of whether or not the single-phase, alternating current system would be adopted in this electrification work. The contracts indicate that it will not. The present contract is for four sub-stations, each to have four 300-kw. rotary converters.

The kind of contact for the cars has not been decided upon; the engineers are still undecided between third-rail and a side-contact system. As intimated some ago, an overhead trolley was considered undesirable because of the gases arising from steam locomotives, and because of the danger to trainmen on tops of freight cars. The line voltage therefore will be in common with that of the Utica & Mohawk Valley, with which the Syracuse-Utica line will be connected. The West Shore between these points is being four-tracked, and two tracks will be equipped for electricity. The work is to start in the very near future. The West Shore through passenger trains between these points will be diverted to the New York Central tracks; in fact, this is being done very largely at the present time. Freight trains will continue to operate as heretofore. Four 125-h.p. motors will be the car equipment, and the GE type M control will be used, as it is proposed to run the cars in trains of three or four. In entering the streets it will be necessary, of course, to cut the trains and operate the cars through cities singly.

It was intimated some time ago that the Auburn branch would be electrified to fill the gap between Syracuse and Rochester. This plan has been modified. Instead the syndicate has acquired the Rochester & Eastern Railway, operating from Rochester to Geneva, 50 miles. The 50 miles from Geneva to Syracuse will be filled either by electrifying that portion of the Auburn branch or building a separate line. Between Rochester and Buffalo the syndicate has no plans that it cares to speak of at present, but the West Shore tracks could be utilized. As outlined, this gives a continuous line from Rochester to Little Falls, a distance of about 160 miles, the plan for operation of which has been fully determined upon. As is generally known, the syndicate owns the Schenectady Railway, operating a 14-mile line from Schenectady to Albany, with other lines to Troy and Ballston Spa. From Schenectady westward to Tribes Hill, 22 miles, is the fine double-track line of the Fonda, Johnstown & Gloversville Railway. It is denied that this system has been acquired, but it seems reasonable to suppose that it will come into the chain when the links are connected up. From Tribes Hill to Little Falls, 35 miles, there is no line at present.

At the present time the Utica & Mohawk Valley leases power from the Trenton Falls water-power. This service will be abandoned as soon as the 33,000-volt transmission lines from the plants of the Hudson River Power Co. near Lake George, and which are now supplying the Schenectady system, are extended westward to Syracuse, giving a transmission line of about 126 miles. From Syracuse westward the power will be supplied by Niagara Falls power, a contract having recently been made with the Ontario Power Co.

Under the plans outlined, it is apparent that the local traffic through Central New York is to be taken care of by means of frequent service on these interurban lines, but there is nothing to indicate that at the present time the New York Central has plans for electrifying its main lines for the through passenger service. The electrification which is being done out of New York City is simply to improve the metropolitan terminal facilities and suburban service.

ANNUAL CONVENTION NEW ENGLAND WATER WORKS ASSOCIATION.

The twenty-fourth annual convention of the New England Water Works Association will be held at New York on Sept. 13 to 16, at the Murray Hill Hotel. Reduced rates on the certificate plan have been secured from all points in the territory covered by the New England Passenger Association, the Trunk Line Association and the Central Passenger Association. All interested in problems relating to water supply are cordially welcomed at the meeting of this association, and an invitation is extended to all who are eligible to become members. Convenient rooms have been secured for the exhibits of associate members and an interesting and instructive display is expected.

Wednesday, Sept. 13.—Meetings for presentation of papers, 9.30 to 12.30; and 2.30 to 4.30. Ladies' excursion, 2.30 to 5, automobile ride about the city; 8.15 p. m., Hippodrome.

Thursday, Sept. 14.—Meeting for presentation of papers, 9.30 to 12.30. At 3 p. m., boat trip on Hudson and East Rivers, landing at Coney Island in time for dinner, followed by visits to the various attractions there. Return by boat to New York.

Friday, Sept. 15.—Meetings for presentation of papers, 9.30 to 12.30, and 8 p. m. Afternoon, inspection of Subway and Subway power station.

Saturday, Sept. 16.—All-day trip to the Croton Dam for the supply of water to New York City.

Members and guests are invited to visit the following water works and manufacturing plants: Hackensack Water Co., D. W. French, Supt., new filtering plant in course of construction at New Milford, N. J.; East Jersey Water Co., A. W. Cuddeback, Supt., filter plant and pumping station at Little Falls, N. J.; A. P. Smith Mfg. Co., Newark, N. J.; Neptune Meter Co., Long Island City; Henry R. Worthington, Harrison, N. J.

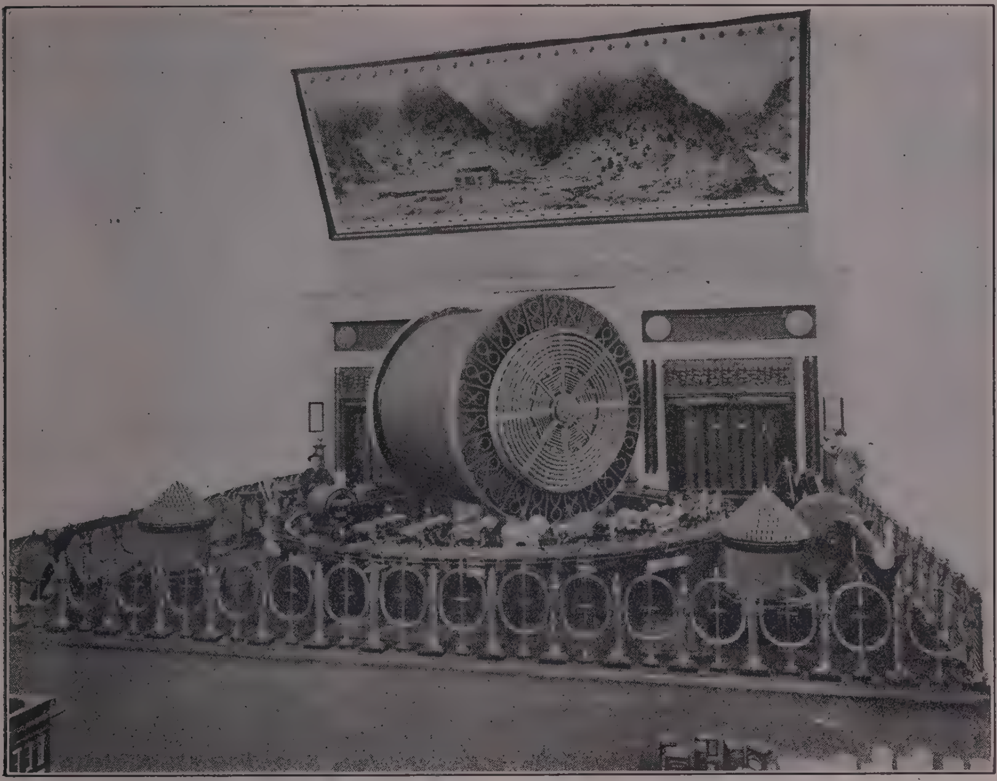


EXHIBIT OF THE BRODERICK & BASCOM ROPE CO.

THE LEWIS AND CLARK EXPOSITION

The W. G. McPherson Co., of Portland, Ore., show in the Manufacturers' Building an 18 x 38 ft. cottage of old English style, ventilated and cooled by the McPherson fan system of ventilating and cooling. This essentially consists in drawing air by a suction fan from the exterior of the building, over water-cooled coils enclosed in sheet steel casing, and discharging it, in this instance, at the rate of 300 ft. per minute, through ducts leading to ventilators placed eight ft. or so above the floor in the desired apartment. The temperature is kept constant by the Johnson system of temperature regulation. The air is allowed to escape from the building through suitable ventilators. With this plant the management can cool the temperature from 95° to 65° Fahr. with ease. The necessary mechanism of the McPherson Co.'s system of ventilating cooling occupies but 10 x 18 ft. in this exhibit. The fan is electrically driven at the rate of 640 r.p.m., and is sufficiently powerful to furnish 1,200 cu. ft. of air per minute into the apartment.

The exhibit of the Broderick & Bascom Rope Co. of St. Louis, presents a most unique appearance. The central figure is a large spool 10 ft. in diameter and 8 ft. wide, mounted on a rotating turntable and wound with 32,000 ft. of 1½-in. cable, having a breaking strength of 175,000 lb. On the outside flanges of the spool are two 7-ft. rotating disks containing all the various sizes and styles of rope made by the Broderick & Bascom Rope Co. Around the spool is a track 20 ft. in diameter on which is run a miniature spool of cable on a model of their Jumbo steel wagon drawn by thirty horses. On the same track is shown also in miniature a trainload of wire rope supplies for the logging country, drawn by a model locomotive, while outside the circular track is a miniature aerial tramway. In the rear are two cabinets containing 5-in. "Power" steel ropes capable of sustaining 2,500,000 lb. Above the cases are electric signs which flash the name "Power Rope" in many colored letters. A very interesting feature in this connection being a carving set made entirely from "Power" rope. The knife is 3 ft. long with a perfect rope handle; the fork and steel being in proportion.

Hung near the top of the exhibit is a 30 x 12-ft. painting representing a typical logging scene in the red wood country of California. In front of the booth are pyramids of wire rope paper weights, set on a base supported by a cable 3 ft. in diameter, while the entire display space is surrounded by a wire rope fence of beautiful workmanship. The entire exhibit was constructed at the company's factory in St. Louis, under the supervision of its general superintendent and mechanical engineer, Mr. E. P. Frederick.

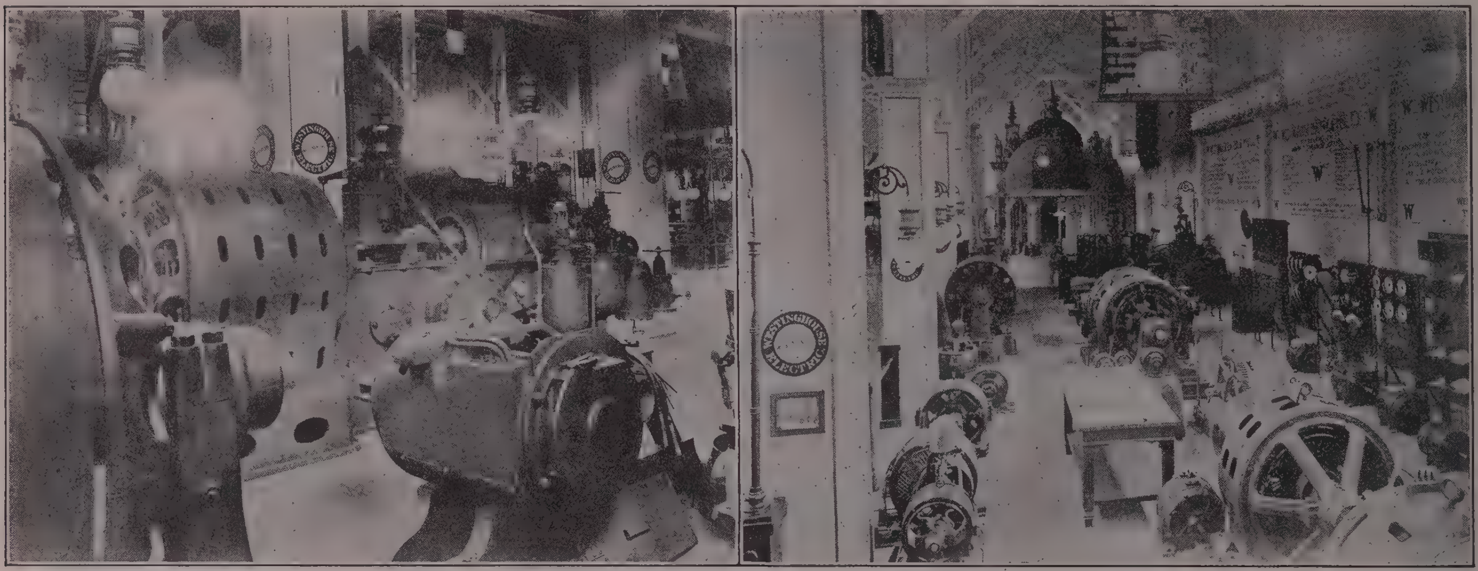
In the exhibit of the American School of Correspondence of Chicago is shown some of the results attained in the last eight years of teaching by correspondence the multitude who have been deprived of the benefits of a residence school training. A large map on the rear wall shows the geographical distribution of electrical engineering students. Students are shown in Russia, in South Africa, South America, Alaska, China, Japan, Australasia, Fiji and the Hawaiian Islands. Tool work, pattern making, and wood work of students are shown, as are also some of the corrected examinations and mechanical drawings. An automatic telegraph instrument illustrates the method of teaching telegraphy by mail. Records are made on long strips of paper which, passing over the automatic key, reproduce messages placed upon them in much the same way as a phonograph record reproduces the sound of the human voice.

The Dodge Mfg. Co. of Mishawaka, Ind., shows an 18-ft. electrically driven jack shaft, supported on adjustable floor stands, and running in ring and chain oiling bearings. The shaft is fitted with wood and iron split pulleys having interchangeable bushings and split friction clutches. From a 4-ft. nine-groove sheave on the jackshaft and leading to an 8-ft. nine-groove sheave with idler and tension carriage supported between, is shown in operation the Dodge system of rope transmission. A large display of drop and post hangers, floor stands, pillow blocks, couplings, collars and clutches go to make up a very interesting and imposing exhibit.

Fairbanks, Morse & Co., which is now devoting a large amount of attention to gas engines, uses 5,200 ft. of space largely for this specialty. The central feature of its exhibit is a 50-h.-p. vertical engine driving the dynamo which furnishes current for lighting the booth. Gas, gasoline, kerosene and crude oil engines of various types and sizes are shown, and also some of the combinations made by the company, such as electrical generating units, direct connected engines and air compressors, and hoists driven by gasoline engines. The company's exhibit in the railway field is also comprehensive, running up from track tools to an inspection car driven by a gasoline engine. The scale exhibit is a large one, and a 100-ton railway scale with printing beam attracts much attention. The company's windmills and irrigating apparatus are shown near the entrance to the grounds, and a kerosene engine and centrifugal pump are located with the outdoor mining exhibits.

The General Electric Co. has the largest space, 6,000 sq. ft., of any exhibitor at the exposition, and in addition is able to show two 1,500-kw. Curtis turbine units at the new power house of the Portland General Electric Co., recently described in this journal, and a number of motor outfits driving apparatus displayed by other companies. A small Curtis turbine is exhibited in the company's booth, and there is a generator direct-connected to a 30-in. Pelton wheel in such a way that its operation can be easily observed. A Platt Iron Works triplex pump is exhibited in order to show its operation by a three-phase induction motor, and there are numerous small motors running hoists, sewing machines, printing presses, centrifugal pumps, emery wheels and the like.

In the railway department may be mentioned a four-motor equipment on Brill trucks with controllers, similar to the equipment furnished to the Washington Water Power Co. Another striking exhibit is an 8-ton electric mining locomotive. The display of line and track specialties is large, and the exhibit of switchboard equipments for railway purposes is particularly interesting. A 60,000-volt oil switch attracts much attention from those interested in long distance transmission. A large section of the space is devoted to lighting department apparatus, wire, cable sockets, fuses, lightning arresters, porcelain specialties, indicating and recording instruments. A 30-ampere mercury arc rectifier changing 220-volt 60-cycle alternating current into 110-volt direct current is shown in operation, and the display of lamps is very complete.



WESTINGHOUSE EXHIBITS OF STEAM TURBINES, ALTERNATING AND DIRECT-CURRENT MOTORS AND GENERATORS.

The Westinghouse Electric & Mfg. Co. has as its main feature a 400-kw. Westinghouse-Parsons turbo-generator, and in contrast with this type of unit there is a 2-kw. generator direct connected to a high-speed Ohmen engine. A 120-kw. revolving-field alternator is also shown. The motor exhibit is a large one. As representing railway equipments, a 50-h.-p. direct-current motor and a 75-h.-p. alternating current motor are shown, and also a switch group of the multiple control system. Groups of type R and type S motors are exhibited, including a vertical machine of the latter class, a group of induction motors for constant and variable speed, a good representation of the crane motors, both alternating and direct current, made by the company, and a 100-h.-p. induction motor.

A 25-kw. rotary converter and a motor-generating set having a 150-h.-p. induction motor and a 100-kw. direct-current engine-type generator are shown. The exhibit of transformers includes a 110-kw. air-blast set, and groups of the OD, and N types. Switchboard apparatus of many varieties is displayed on the walls of the space. Fuses, a double-throw oil switch, a static interrupter, choke coil and lightning arresters are also exhibited. In the controller section are found an oil-immersed auto-starter for CCL motors, a rheostatic controller for HF motors, an elevator controller, an automatic pump controller, and a three-wire double-voltage controller for direct-current motors driving machine tools.

Two special exhibits are attracting much attention. One is an automatic dust removing plant made by the Sanitary Devices Mfg. Co.; this is driven by a type S motor. The other is a rope hoist manufactured by the Denver Electric Co., to which is connected a type F induction motor.

The central heating system of the Citizens' Mutual Heating Co., Terra Haute, Ind., is described in a book by W. H. Schott, Marquette Bldg., Chicago. This also contains illustrations of many of the buildings heated, with letters from their owners concerning the character of the service.

PERSONAL NOTES.

Mr. E. B. Jones has resigned the office of city engineer of Chatham, Ont.

Mr. Frank Lee has been appointed engineer of the central division of the Canadian Pacific Ry., succeeding Mr. J. E. Schwitzer, recently transferred.

Mr. L. E. Thomas, formerly with the Lloyd Booth plant of the United Foundry & Engineering Co., has become general manager of the Birdsboro Steel Foundry & Machine Co., of Birdsboro, Pa.

Mr. Oscar F. Lackey, an assistant engineer of the Baltimore Harbor Board, has resigned his position to enter the engineering staff of the Isthmian Canal Commission. He has had about seven years' experience in engineering work in Cuba.

Mr. Herman Schussler has resigned his connection with the advisory board of consulting engineers of the Isthmian Canal Commission, and the position has been offered to Mr. John B. Berry, chief engineer of the Union Pacific Ry.

Mr. Benjamin E. Winslow has been appointed to the new position of architectural engineer in the office of the building department of Chicago. He is a graduate of the Copenhagen Technical School and has been architectural engineer of the Board of Education of Chicago for the last eight years.

Mr. E. G. Howard will become electrical engineer of the Coffin Valve Company, Boston, early this month. He is a member of the American Institute of Electrical Engineers, and has been identified with the Chapman Co. for the past four years, engaged in the development and placing on the market of valves operated by electricity. He was previously with the General Electric Co.

W. A. Cattell, M. Am. Soc. C. E., has accepted a position with the banking house of E. H. Rollins & Sons of Boston, Chicago, Denver and San Francisco, to look after their engineering work on the Pacific Coast. Mr. Cattell has turned over his consulting practice and New York office to Messrs. Ford & Waldo, consulting and contracting engineers, who will continue such work as he had in hand, and will start for San Francisco about the middle of September.

Mr. J. W. Frazier and J. H. Fox, who have been connected with the designing and contracting department of the Brown Hoisting Machinery Co. for about six years, and Mr. J. C. Spencer, for several years with the American Bridge Co., and lately in consulting practice in Cleveland, have formed a partnership under the firm name of Frazier, Fox & Spencer, with offices in the Rockefeller Building, Cleveland. The firm will make a speialty of bridges, buildings, power and industrial plants, docks and terminals.

Mr. Alfred I. Major has announced his resignation of the presidency of the American Bridge Co., and the selection of Mr. August Ziesing, of Chicago, as his successor. It is expected that official notice of these changes in the company will be issued after the regular meeting of the directors on Sept. 21. Mr. Ziesing has made an unusually fine record in the structural steel business in the Chicago district, both before and after the formation of the American Bridge Co., and his selection as president of the company is doubtless due to this fact.

Mr. F. Herbert Snow has accepted the position of head of the sanitary division of the Pennsylvania Department of Health, and will make his headquarters in Harrisburg. The legislature recently passed some drastic bills to prevent the pollution of water courses and placed their enforcement in the hands of a good commission, which is losing no time in bringing about the organization of the work proposed by the acts. The appointment of an engineer of such high standing as Mr. Snow indicates the thoroughness with which the commission is proceeding.

There have been a number of promotions recently on the engineering staff of the Pennsylvania lines, following the appointment of Mr. G. H. Burgess as engineer in charge of the Erie terminal improvements at Jersey City. He is succeeded as assistant engineer on the Northwest system of the Pennsylvania lines by Mr. D. Y. Swaty, at present holding a similar position on the Southwest system. Mr. Swaty will be succeeded by Mr. Charles E. Rowe. Mr. Swaty has been with the Pennsylvania for six years, starting as a draftsman, while Mr. Rowe has been with the company for twelve years.

Mr. Jesse A. Vail, manager of engine sales department, New York office, Allis-Chalmers Co., has resigned to become general manager of the Beloit plant of the Fairbanks, Morse Mfg. Co. He was connected with the Hamilton-Corliss works at Hamilton, O., for 14 years, the latter part of the time as superintendent, and left that company to join the Allis-Chalmers Co. three years ago.

Mr. T. C. Phillips has resigned his connection with Mr. John A. Cole, consulting engineer of Chicago and New York, to become assistant engineer in the Bureau of Engineering, Department of Public Works of Chicago, and will have charge of the operation of the intake cribs and pumping plants of the municipal water works.

Mr. H. F. J. Porter has opened offices at 1 Madison Ave., New York, for consulting engineering practice, introducing modern methods of organization and management leaning towards industrial betterment and welfare work, a subject that all progressive companies regard as highly important although few understand just how to effect any change from the old methods to those which recognize that employes are human beings rather than machines. Mr. Porter's experience specially qualifies him for such work. After graduating in 1878 from Lehigh University, he spent four years in the Delamater shops in New York, in charge of the ice machine department, and two years as assistant engineer with the New Jersey Steel & Iron Co. In 1884 he was appointed superintendent and engineer of the buildings and grounds of Columbia University, where he remained until 1900, when he became superintendent and engineer of the Carey & Moen Steel & Wire Works. In 1893 he was made assistant mechanical engineer of the Columbian Exposition, and a little later assistant chief of its Machinery Department. At the close of the Exposition he became western manager of the Bethlehem Iron Co., and was particularly sucessful in introducing the use of hollow shafts for large engines and in extending the use of nickel steel. In 1897 he was transferred to South Bethlehem, where he was instrumental in introducing many improvements in organization and management, and in 1901 he was appointed assistant manager of the company, with offices in New York. The following year, when the company became involved in the U. S. Shipbuilding complications, Mr. Porter joined the Westinghouse Companies' Publishing Department, from which he was transferred in 1902 to the position of second vice-president of the Nernst Lamp Co., with the duties of general manager. At that time the product of the company was not regarded with favor and the educational campaign that was begun to introduce the apparatus and the engineering and manufacturing improvements which were adopted to enhance its value are too well known to need comment.

BUSINESS NOTES.

The Green Fuel Economizer Co., Matteawan, N. Y., has just completed a large shop, where it will build in addition to fuel economizers a large variety of fans, blowers and exhausters. The company has recently been working on new designs in which the power required for driving has been reduced to a minimum.

Eighteen Ransome concrete mixers mounted on trucks are used by Wm. Bradley in putting in the concrete lining of the Jerome Park reservoir in New York.

The Reinforced Cement Construction Co., of New York, has secured the contract for erecting a large printing building for the S. S. McClure Co. The structure will be built wholly of reinforced concrete, materials for which will be purchased shortly.

The Drake Standard Machine Works, of Chicago, recently received by telegraph an order for four large continuous concrete mixers with feed and measuring boxes. Other recent orders have come from Jardine, Brewer & Tomlinson, Chillicothe; Weber Steel-Concrete Chimney Co., Chicago; Cook & Laurie Contracting Co., Montgomery and Atlanta; William Fife & Son, Indianapolis; H. Huennekes Co., New York City and Chicago; Fred. Hoffman, Hartford City, Ind.; Great Lakes Dredge & Dock Co., Chicago; United Railways Co., St. Louis; W. W. Hatch & Sons, Detroit; Contracting Engineering Co., Tacoma; National Bridge Co., Indianapolis; Orford Copper Co., New York; Moore-Mansfield Construction Co., Indianapolis; Central States Bridge Co., Indianapolis; Boone County Construction Co.; J. H. Chittick, Los Angeles; H. B. McAfee, Parkville, Mo.; Miller Bros., North Vernon, Ind.; Cement Block & Construction Co., Bellefontaine, O.

A hoisting engine just shipped to the Centennial Copper Co., from the Chicago works of the Sullivan Machinery Co., is of the direct acting type and consists of two 36 x 60-in. simple, reversible Corliss engines of the heavy duty type, connected to a straight-faced drum, 15 ft. in diameter by 15 ft. winding face. The drum is grooved for 1⅜ in. wire rope and is keyed direct to the engine shaft. The plant is designed to hoist from a vertical depth of 5,000 ft. The reverse engine may be operated by either steam or air. The brake mechanism is arranged for steam, hand or gravity operation, with independent control in each case. The main throttles are on the cylinders, moved by hand from the engineer's platform. A sensitive and powerful automatic stop and throttle closing device is another important feature.

York Mfg. Co., York, Pa., manufacturers of ice making and refrigerating machinery, report the receipt of the following orders: Ten-ton compression side for the Kendall Refining Co., Bradford, Pa.; 6-ton ice-making plant for the Gold Center (Nev.) Brewing & Ice Co.; 30-ton compression side and brine cooler system for V. Frank's Sons Brewery, Poughkeepsie, N. Y.; two 40-ton refrigerating machines, freezing system and piping for boxes for Knickerbocker Hotel, New York; 10-ton compression side and distilling system for the Kosciusko (Wis.) Ice & Cold Storage Co.; 100-ton ice plant for Santa Fe Car Icing Co., Argentine, Kan.; 10-ton compression side and brine cooler outfit for Grand Detour Plow Co., Dixon, Ill.; two 100-ton shell brine coolers for Independent Cold Storage & Warehouse Co., Philadelphia, Pa.; one 3-ton and one 6-ton compression side, two complete 1-ton ice-making plants, and one 10-ton compression side for Agar, Cross & Co., for shipment to Buenos Aires; one 3-ton compression side for Waygood Co., Ltd., Sydney, Australia.

The Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill., reports an unusually heavy business and states that its various shops are working night and day. The rapidly increasing demand for pneumatic tools has required the company to install a large amount of automatic machinery in its different plants. Among the orders the company has recently received is one for a compressor and a complete outfit of pneumatic tools for the new steel car plant of the Western Steel Car & Foundry Co.; three compressors with a capacity of 750 cu. ft. of free air a minute, for the Baltimore & Ohio R. R.; a compressor with 2,000 ft. per minute capacity for the Buffalo plant of the American Shipbuilding Co.; one 1,000-ft. compressor for the Huntington, W. Va., shops of the Chesapeake & Ohio R. R.; $11,000 worth of tools for the Pressed Steel Car Co., of Pittsburg; a 1,200-ft. compressor for the Norfolk & Western R. R.; 3,200 tools for European business, approximating $100,000, and one 165-ft. and two 425-ft. compressors for Bartlett & Hayward, of Baltimore, Md.

The Montreal Light, Heat & Power Co. has employed the Ambursen Hydraulic Construction Co., of Boston, as contracting engineers to reinforce its solid dam at Chambley on the Richelieu River. The work involves the laying of several thousand yards of concrete under from 20 ft. to 25 ft. of water. The work will be largely performed by divers. It will be carried on night and day by the use of submarine electric lights.

The Robins Conveying Belt Co., 21 Park Row, New York, is about completing a large order for the Elizabeth Copper Co., Stafford, Vt., and is at work on a one-ton mast-and-gaff rig for the 44th St. station of the Consolidated Gas Co., New York. Among the undertakings for which it is preparing plans are the improvements to be made at the Newark works of the National Metallurgical Co.

G. M. Gest, of New York and Cincinnati, subway contractor, has been awarded a contract at Fitchburg, Mass., for the construction of a complete subway system for the Fitchburg Gas & Electric Light Co. This makes the fifth city in Massachusetts in which Mr. Gest has constructed conduit systems.

The Robins Conveying Belt Co., of New York, has, among the work now on hand, the contract for coal conveyors and elevators for the Haverhill Electric Co., of Haverhill, Mass.; the contract for the coal-handling machinery for the boiler house of the Arlington Mills Co., of Lawrence, Mass., and an order for belt conveyors for the New Jersey Zinc Co.'s plant at Palmerton. It is also about to complete several large export shipmets for Germany and South Africa.

For the past ten years the Wainwright feed water heaters, Dean reheaters, surface condensers, expansion joints, heat extractors and air coolers have been made in the shops of the Taunton Locomotive Mfg. Co., of Taunton, Mass. The voluntary liquidation of the Taunton company has afforded an opportunity to Mr. W. R. Billings, its treasurer and general manager, to purchase from the Wainwright Mfg. Co. the patents, name and good-will, and from the Taunton company the drawings, patterns and special tools necessary for a continuation of the Wainwright business. After Sept. 1, it will be carried on under Mr. Billings' direction. Correspondence until Sept. 1 should be sent to Mr. Billings at Taunton, but after that date to the Alberger Candenser Co., 95 Liberty St., New York, and Home Insurance Bldg., Chicago.

The Power Specialty Co. of New York has been compelled to seek more commodious quarters and has accordingly moved its offices from 126 Liberty St. to the Trinity Building, 111 Broadway.

The Morse Chain Company, Trumansburg, N. Y., is building at Ithaca, N. Y., a plant of about five times the present capacity. The company was incorporated in 1898, no change having been made either in the name or personnel since starting, Mr. F. L. Morse being the treasurer and general manager. The plant was originally started for the manufacture of bicycle chains, but in 1901 the company brought out its high-speed, silen-running chain, which has proved very successful. In the line of power transmission the Morse Co. has in service chains transmitting over 75,000 hp. and is furnishing drives up to 500 hp. for a single transmission.

The Crocker-Wheeler Company is in receipt of an order for a 200-kw, three-phase, 60-cycle, engine-type, alternating-current generator for the Ivorydale (Ohio) lighting and power plant of the Proctor & Gamble Co. This machine is a duplicate of the first Crocker-Wheeler alternator ever built, which was installed ten months ago in the Atlanta plant of the Proctor & Gamble Co.

TRADE PUBLICATIONS.

In a little pamphlet entitled "Specifications for Artificial Stone Sidewalks," the Anderson & Sons Co., 17 St. Aubin Ave., Detroit, gives much useful information concerning such work and the tools used for the purpose. The construction of these walks has become such a specialty that a complete line of equipment, ranging from small hand-driven mixers to special edging tools and groovers, are now made for it. The pamphlet suggests the use of cement specifications which are not strict enough, otherwise the advice seems thoroughly up to date.

The blowing engines of the Southwark Foundry & Machine Co., Philadelphia, are well known throughout the country, yet a handsome new catalogue of them contains considerable information which it would be difficult to obtain elsewhere. Particular attention is called to the high-speed blowers which will be built to run at 85 r.p.m. or more, if desired. The regular steam-driven vertical and horizontal machines are fully described, and a special section of unusual interest relates to the design of blowers for operation by gas engines using blast furnace gas.

The American Blower Co., Detroit, Mich., has revised its catalogue of exhaust fans. Type E is a steel plate design in which the housing can be so shifted as to adjust the fan to a variety of positions. Type V has a cast-iron reversible housing or shell. In the Dixie type there are four feet on each side of the housing, thus making it possible to place the fan so as to secure a discharge in any direction. Type P is for high pressure. The catalogue gives full details of construction and dimensions of the various types and sizes, and also gives useful data concerning the design of flues, the selection of fans and related subjects.

It is now nearly thirty years since Thomas Murphy began his investigations of methods of mechanical stoking and smoke prevention. He was then an engineer on a tug boat and the cheapness of slack coal at the lake ports drew his attention to the subject. From that beginning the Murphy automatic furnace has been evolved and the large plant of the Murphy Iron Works at Detroit has been built up. The company has recently issued the 21st edition of its general catalogue describing the stoker and explaining what it will do. This pamphlet contains many illustrations which are instructive as well as attractive, and the description of the apparatus is unusually clear. Engineers engaged in power plant design will also find the views in numerous boiler plants of much interest.

Two of the new bulletins of the Allis-Chalmers Co., Milwaukee, are particularly valuable to water works superintendents and engineers. No. 1600 gives a summary of the 30,000,000-gal. Allis engine at the Chestnut Hill high service station of the Metropolitan water works, and No. 1601 gives similar data concerning a 15,000,000-gal. Allis engine at the Baden station of the St. Louis water works. Both these engines have been fully described in this journal, but the data were published several years ago and these pamphlets will prove useful to readers who do not preserve their files of the paper. The Allis-Chalmers Co. has also issued two large catalogues of very handsome appearance. One of them describes the company's well-known drum, reel and Whiting system hoisting engines, fleeting engines, indicators, hoisting hooks, cages, cage chairs, skips, buckets, cars, sheave wheels, landing dogs and other equipment used in hoisting work. Special attention is drawn to the section of the catalogue giving the company's rules and tables for selecting the size of rope for any purpose. The second catalogue refers to Allis-Chalmers smelting machinery, which includes in addition to engines and electrical apparatus, blast furnaces for lead and copper ores, hot blast stoves, water jackets, forehearths, pots, charging apparatus, blowers, and the like.

The new power transmission catalogue of the Dodge Mfg. Co., Mishawaka, Ind., is a book of 416 pages of an encyclopedic character. It describes and lists a great variety of couplings, collars, hangers, pillow blocks, boxes, step bearings, floor stands, brackets, belt tighteners, guide pulleys, clutches, belt shifters, wood and iron pulleys, spur and bevel gears, friction gears, link belting, rope transmission equipment, spiral and belt conveyors. A large amount of information concerning the methods of selecting such supplies for a given service is scattered through the book, and there are many pages of tables and data of value to power transmision designers. In fact, the contents of the book are so varied that the index occupies 17 pages, which fact explains the impossibility of printing here a complete list of the articles described.

Catalogue R of the Ransome Concrete Machinery Co., 11 Broadway, New York, is particularly interesting for its detailed description of the new Ransome mixer. This is a continuous machine of the drum type, without tilting features and arranged very low, so that high platforms are unnecessary as runways for the wheelbarrows bringing the stone and sand to the mixer.

The Crane Co., of Chicago, is issuing advance sheets of an unusual sort of catalogue. One of these is a discussion of the various styles of joint used in attaching flanges to wrought pipe, among them being the Cranelap, a new style. Another folder illustrates new hot-water radiator valves operated by the foot. Another folder illustrates a new combination back-pressure and relief valve, made in several patterns. A fourth folder describes a new renewable spring-disk brass valve suitable for working pressures up to 150 lb.

The Wm. Powell Co., Cincinnati, has issued a pamphlet describing in detail its White Star reversible disk valves. Their special feature is the disk and the design of the parts by which everything necessary for regrinding is a part of the valve. They are made in many styles and for many classes of service.

An unusual departure in trade literature is furnished in "What You Do Not Know About Rust-Proof Paint," issued by Rinald Bros., 1142-1146 N. Hancock St., Philadelphia. There is nothing technical about the contents, but some very good ideas about the choice of paints for iron and steel, for example: "You can not protect iron with barn paint any more than you can make an omelet with egg plants."

When the physical properties of nickel steel as compared with those of carbon steel are better known and more fully appreciated, the amount now used for purposes for which it has already been successfully introduced will be considerably augmented and new applications will undoubtedly result. The properties of nickel steel are influenced not only by the proportion of nickel present, but also by the amount of carbon and manganese contained in the steel, and furthermore by the presence of some other element like chromium or tungsten. In a pamphlet issued by the Orford Copper Co., 43 Exchange Place, New York, entitled "Nickel Steel, Its Properties and Applications," the subject is covered at considerable length.

The McWane Pipe Works Department of the Lynchburg Foundry Co., Lynchburg, Va., has issued its first complete catalogue of cast-iron pipe and specials and other supplies for water works. Its bell and spigot pipe of 3 to 24 in. diameter is cast to the standards of the New England Water Works Association, as are most of the larger specials. The catalogue also lists gas pipe, flanged pipe, manhole heads, valve and meter boxes and supplies for pipe layers.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—See "Power Plants, Gas and Electricity."

Anaheim, Cal.—See "Power Plants, Gas and Electricity."

Aspen, Colo.—Geo. Newman is stated to have petitioned Council for a franchise for water works.

**Trinidad, Colo.*—T. J. Murphy is stated to have on Aug. 17 secured the contract for constructing a pipe line for $15,300.

Denver, Colo.—The Park Comn. are stated to have employed J. G. Barri to prepare plans for a pumping station, to cost about $20,000.

**Greenwich, Conn.*—Engr. A. B. Hill, of New Haven, writes that the contract for constructing a concrete dam, containing about 2,500 cu. yds., for the Greenwich Water Co. (bids opened Aug. 25) has been awarded to the Godwin Constr. Co., 60 Wall St., New York, N. Y.

Wilmington, Del.—The Water Comrs. on Aug. 21 are stated to have authorized the engineers to prepare plans for a new filter plant. Theo. A. Leisen, Ch. Engr. Water Bd.

Barnesville, Ga.—The City Council is stated to have purchased a large spring near this city, to be used for an increased water supply.

Griffin, Ga.—A survey is reported as being made for a reservoir with a capacity of 8,000,000 gal.

Ft. Screven, Ga.—Bids will be received by Jos. T. Davidson, Q. M., U. S. A., until Sept. 29 for enlarging pump house and installing boiler and pumps; also sinking two 6-in. wells at Ft. Screven, as advertised in The Engineering Record.

**Chicago, Ill.*—The contract for furnishing and constructing about 450 pieces 16-in. and 1,350 pieces 24-in. water pipe (bids opened Aug. 22) has been awarded to the U. S. Cast Iron Pipe & Fdy. Co., of Chicago, at $24.55 per ton.

Hoopeston, Ill.—See "Public Buildings."

Marion, Ind.—F. E. Petrie, City Engr., writes that all bids opened on Aug. 22 for constructing a 2,000,000-gal. reservoir were rejected on account of irregularities, and new bids will be received until 9.30 a. m., Sept. 5.

**New Albany, Ind.*—Beeman & Schefold, of Louisville, Ky., on Aug. 25, secured from the New Albany Water Co. the contract for constructing new intake, pump, well and motor house for the new pumping station, water to be taken from Ohio River.

Waterloo, Ia.—The question of constructing municipal water works is reported under consideration here.

Stafford, Kan.—The citizens of this place are reported to be discussing the question of constructing water works. Robt. Garvin and C. G. Webb are reported interested.

Herington, Kan.—See "Power Plants, Gas and Electricity."

Arkansas City, Kan.—It is reported that it is proposed to purchase new pumps for the water works.

Donaldsonville, La.—See "Schools."

Yarmouth, Me.—The citizens are reported to have voted to purchase Hayes Spring, to be used as a new water supply; also to appropriate $25,000 for installing new system of mains, etc.

It is stated that bids will be received for the above extensions until Sept. 5 by the Water Comrs. C. L. Buckman, Chmn. Selectmen.

**Ft. Revere, Mass.*—Jos. J. Callahan, Atlantic, Mass., has secured the contract for extending the post water supply, and installing new pump at Ft. Revere, for $2,100.

Comfrey, Minn.—The Des Moines Iron Wks., of Des Moines, Ia., is reported to have submitted the lowest bid for water works at $7,280.

Perham, Minn.—The citizens are reported to have voted to issue $5,000 bonds for water extensions.

St. Cloud, Minn.—The following are reported to be the bids opened by City Council on Aug. 21 for the construction of a mechanical filtration plant: Union Filter Co., Pittsburg, Pa., $22,570; Pittsburg Filter Co., Pittsburg, Pa., $8,064; Wm. B. Scaife & Sons Co., Pittsburg, Pa., $5,700, if cypress is used $6,000; Federal Filtration System, New York, N. Y., $17,546; Norwood Engr. Co., Florence, Mass., $23,350; Roberts Mfg. Co., Philadelphia, Pa., $25,000; Jackson Filter Co., St. Louis, Mo., $15,000; Greer Filter Co., Philadelphia, Pa., $14,285, and H. J. Eberman, Minneapolis, Minn., $10,000.

Thief River Falls, Minn.—Lars Backe, City Clk., writes that the citizens voted Aug. 21 to issue $25,000 bonds for water works. Engineer Oscar Claussen, German American Bank Bldg., St. Paul.

Cloquet, Minn.—The Council is reported to be considering the question of constructing water works.

Biloxi, Miss.—The question of issuing $10,000 bonds for the construction of a pumping station is reported under consideration.

Grenada, Miss.—C. B. Bolton, Supt. Water Wks., writes that the probable cost of water works improvement is $15,000.

St. Louis, Mo.—Bids will be received until Sept. 13 by the Bd. Pub. Improv. for constructing 2 settling basins for the water department at Chain of Rocks, each to have a capacity of 30,000,000 gals. Estimated cost, $450,000. Benj. C. Adkins, Water Comr.

**Glendive, Mont.*—Contracts for the excavation and structures of the 34 miles of canal, tc be constructed near Glendive, to be known as the Ft. Buford project (bids opened June 1) have been awarded as follows: Excavation, Div. No. 1, to Widell-Finley Co., Mankato, Minn., $163,367; excav. for Div. 2, 3 and 4, to Callahan Bros., Phelan & Shirley, Omaha, Neb., at $159,800, $140,919 and $56,039 respectively. Structures, Divisions 1, 2 and 3), to Chas. Stabern, of Helena, at $40,942, $38,828 and $24,611 respectively, and for Div. 4, to the Deadwood Constr. Co., Deadwood, S. D., for $28,142. F. E. Weymouth, Project Engr., Glendive. For list of bids received for this work, see issue of The Engineering Record June 17.

Helena, Mont.—Martin Doty, City Clk., writes that there is some talk of constructing water works, but nothing definite has yet been done.

**Arlington, Neb.*—Engr. M. A. Earl, 1st Natl. Bank Bldg., Chicago, Ill., writes that the contract for constructing water works (bids opened Aug. 22) has been awarded to Wm. Tunny, of Joliet, Ill., for $12,600.

Hancock, N. H.—A. W. Dudley, of Manchester, has been selected to make examination and estimates for a gravity water system. C. H. Duncan, Chmn. Water Com.

Fayetteville, N. C.—The water works are stated to have been transferred to the city; the purchase price is reported at $79,000.

Haddonfield, N. J.—It is stated that the borough will shortly sink a test well, with a view to providing a municipal water supply.

Constableville, N. Y.—The citizens are reported to have voted to issue $7,000 bonds for water works.

Buffalo, N. Y.—Bids will be received until Sept. 12 by Francis G. Ward, Comr. Pub. Wks., for furnishing and erecting in the engine house at the pumping station 2 vertical, triple-expansion, self-contained pumping engines, each with a capacity of 30,000,000 gal. U. S. standard of water per 24 hours against a head of 200 ft.

Cincinnati, O.—Bids will be received until Sept. 15 by the Bd. Trus., Comr. Water Wks. (Robt. V. Foster, Clk.) for laying 5,950 lin. ft. 20 and 16-in. c.-i. pipe, special castings and valves in portions of Carthage Pike and Mitchell Ave.

Shelby, O.—J. C. Fish, Pres. Shelby Water Co., writes that the Kennicott Water Softener Co., of Chicago, Ill., is installing an elimination plant, the intention of which is to remove iron from the water of this company; it will cost about $20,000. This is about all the improvements contemplated for this year.

Struthers, O.—H. G. Hamilton, of Youngstown, with the Mahoning Valley Water Co., writes that bids will be asked within 30 days for a reservoir to be constructed at Struthers, to cost from $50,000 to $100,000. Engineer, David M. Wise. For further information address Mason Evans.

Cincinnati, O.—Bids will be received at the office of the Bd. of Trus. Comrs. of Water Works until Sept. 29 for the construction of filters, coagulation basin and clear-water reservoir with pipe lines, valve chambers and miscellaneous work in connection therewith near California, as advertised in The Engineering Record.

Malta, O.—W. S. Connor, Village Clk., writes that an election will be held on Sept. 22 to vote on issuing bonds for water works.

Garrettsville, O.—The citizens are reported to have voted Aug. 24 to construct municipal water works at a cost of $40,000.

Ephrata, Pa.—The citizens are reported to have voted Aug. 22 to issue $45,000 bonds to purchase the plant of the Ephrata Water Co.

**Great Bend, Pa.*—M. S. Hotchkiss, of Binghamton, N. Y., is stated to have secured the contract for constructing a dam and reservoir for the Great Bend & Hallsted Water Co., for about $20,000.

**Coatesville, Pa.*—Hugh T. Downing, Boro. Engr., writes that the contract for constructing a cement and mastic asphalt bottom in the reservoir (bids opened Aug. 21) has been awarded to the Vulcanite Paving Co., Real Estate Trust Bldg., Philadelphia, for $5,600.

Belle Fourche, S. D.—Bids will be received at the office of the U. S. Reclamation Service, Belle Fourche, until Oct. 26, for the construction of an earthen dam and appurtenances, and 17½ miles of canals, involving about 2,600,000 cu. yds. earthwork, 3,000 cu. yds. rock excav., 24,000 cu. yds. concrete masonry and 45,000 lbs. steel and cast iron, as advertisd in The Engineering Record.

Aiken, S. C.—The City Council is stated to have selected Engrs. Porter & Norris to survey the routes of Good Spring and Shiloh Branch, two water supplies situated near Aiken, with a view to obtaining a water supply for Aiken.

Franklin, Tenn.—Bids will be received by the Mayor and Bd. of Aldermen until Sept. 12 for constructing a gravity system of water works, as advertised in The Engineering Record.

Muskogee, Ind. Ter.—The citizens are reported to have voted to issue $175,000 bonds for extending the water works and sewerage system and for the erection of 3 new schools.

Floresville, Tex.—The City Council is stated to have selected M. Griffin O'Neal, of Dallas, to prepare plans and superintend the construction of water works.

Pleasant Grove, Utah.—The citizens are reported to have voted Aug. 15 to issue bonds for the construction of water works. Engineers, Lyman & Wilson, Salt Lake City.

Manchester, Va.—A new committee on the clear water question is stated to have been appointed, with C. C. Jones, of the City Assembly, as chairman.

**Puyallup, Wash.*—The Geo. Milton Savage Co., of Tacoma, is stated to have secured the contract for constructing a gravity system of water works for $21,155.

Arlington, Wash.—See "Power Plants, Gas and Electricity."

Blaine, Wash.—The Blaine Water Co. is reported incorporated with a capital of $100,000 by F. A. Boole and J. Buch, of Blaine, and others.

**Colville, Wash.*—Naylor & Norlin, of Lewiston, Idaho, are stated to have secured the contract for constructing water works for $11,825.

Walla Walla, Wash.—The Council is reported to have passed a resolution adopting the plans of Engr. Weile for a gravity system of water works.

Sunnyside, Wash.—See "Power Plants, Gas and Electricity."

Milwaukee, Wis.—See "Power Plants, Gas and Electricity."

Elroy, Wis.—It is stated that a new pump and engine will be added to the water works.

Waupaca, Wis.—The Council is reported to be considering a new source of water supply.

St. Boniface, Man.—Theo. Berhund, City Secy.-Treas., writes that the citizens voted Aug. 11 to issue $40,000 bonds for extending the city water system, $100,000 for the construction of a city hall, for which plans are already adopted, and $8,000 for a fire hall.

Juarez, Mex.—The Council is reported to have approved plans for the municipal water works, to cost about $60,000. Sylvano Montemayor is Mayor.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Pine Bluff, Ark.*—I. P. Shelby is stated to have secured the contract for constructing a storm sewer in the western portion of the city for $5,271.

Bisbee, Ariz.—The question of constructing a sewerage system is reported under consideration here.

Washington, D. C.—Bids are wanted Sept. 11 for constructing the outfall of the sewage disposal system, Potomac River, near Naval Magazine, as advertised in The Engineering Record.

Milledgeville, Ga.—W. F. Wilcox, of Jackson, Miss., has been employed as engineer for the proposed sewerage system.

**Rome, Ga.*—L. J. Wagner is stated to have secured the contract for constructing sanitary sewers in the 1st and 5th Wards, for about $5,000.

Chicago, Ill.—Bids will be received until Sept. 13 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing materials and constructing the intake protection piers and lake shaft for the Lawrence Ave. conduit.

The lowest bid opened on Aug. 19 by the Dept. of Pub. Wks. for constructing the Lawrence Ave. pumping station is stated to have been submitted by John P. Agnew, for $193,670 for granite and $172,311 for Bedford stone.

Bids will be received until Sept. 6 by the Bd. Local Improv. (And. M. Lynch, Pres.) for constructing a sewage pumping station, including building, foundations, machinery, etc., at 95th St. and Erie Ave., South Chicago; also laying c.-i. discharge pipes in a portion of 95th St.; also for constructing a system of concrete main sewers, in connection with said pumping station.

Indianapolis, Ind.—W. R. Williams, Clk. Bd. Pub Wks., writes that bids will be received about Sept. 18 for constructing a sewer in Meridian and 27th Sts., Talbott Ave. and 28th St., from Fall Creek to Central Ave. According to press reports it will be 24 inches in diameter.

Bids will be received until Sept. 6 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for constructing a 10 to 12-in. pipe sewer in an alley east of Parkview Ave.

Winchester, Ind.—C. C. Yunker, City Engr., writes that all bids opened Aug. 16 for constructing 6,400 ft. of sewer here have been rejected. Not yet readvertised.

**Huntington, Ind.*—The contract for the construction of the Rabbit Run sewer is stated to have been awarded to Hines & Bowlin, of Tipton, for $24,832.

Muskogee, Ind. Ter.—See "Water."

**Tulsa, Ind. Ter.*—N. J. Gubser, City Recorder, writes that the following are the bids opened on Aug. 21 for the construction of a sanitary sewerage system: Reynolds & Gamble, Guthrie, Okla. Ter., $32,984; T. R. Anderson, Oklahoma City, Okla. Ter., $26,000; E. T. Likes, Oklahoma City, Okla. Ter., $22,287 (awarded contract); C. Stanton & Co., Coffeyville, Kan., $26,900; McClintock & Sargent, Houston, Tex., $28,500; Charles T. Derr, Guthrie, Okla. Ter., $25,658; J. A. Severns, Guthrie, Okla. Ter., $27,560, and Kinmounth & Hamilton, Joplin, Mo., $33,475. This work will comprise the following items: 32 ft. 15-in. and 270 ft. 10-in. c.-i. pipe; 4,750 ft. 15-in., 4,390 ft. 12-in., 18,835 ft. 10-in. and 3,280 ft. 8-in. vitr. pipe; 65 manholes; 6 flush tanks; 10 lamp holes, and 30 frame bents.

**Items marked thus give the names of parties awarded contracts.*

Downers Grove, Ill.—The following are the bids opened on Aug. 22 by the Bd. of Local Improv. for constructing a system of storm water drains: (*a*) C. T. Bartlett, Evanston, $17,577; (*b*) F. G. Mortimer, Glencoe, $17,619; (*c*) Harding & Nelson, Racine, Wis., $18,968; (*d*) J. W. Barker, Melrose Park, $18,458; (*e*) Andrew Maloney, Chicago, $17,191; (*f*) Jas. Healy, Morgan Park, $18,283; (*g*) Jno. H. McCarthy, Chicago, $19,865; (*h*) A. C. Schriter & Co., Manitowoc, Wis., $17,178 (awarded contract), and (*i*) McNichols & Co., Chicago, $17,867:

	a	*b*	*c*	*d*	*e*	*f*	*g*	**h*	*i*
1,885 ft. 48-in. concrete	$4.00	$4.00	$5.20	$5.00	$4.00	$4.90	$5.00	$4.80	$4.57
20 ft. 30-in. pipe	3.00	2.25	3.15	2.50	2.35	2.50	3.00	2.56	2.50
480 ft. 24-in. pipe	1.75	1.65	1.97	2.00	1.40	1.40	2.50	1.47	1.75
2,000 ft. 20-in. pipe	1.50	1.35	1.32	1.50	1.45	1.25	1.25	1.17	1.25
1,330 ft. 18-in. pipe	1.05	1.20	.91	1.00	1.10	1.00	1.00	.83	1.00
2,180 ft. 15-in. pipe	.95	1.00	.77½	.75	.85	.90	.80	.64	.75
780 ft. 12-in. pipe	.74	.70	.63	.50	.60	.65	.70	.51	.60
30 manholes	18.00	30.00	25.00	20.00	15.00	19.00	25.00	25.00	25.00
56 gutter inlets connected	22.00	20.00	25.00	20.00	18.00	19.00	15.00	20.00	15.00
800 ft. open ditch drain	.40	.25	.40	.25	.50	.50	1.00	.32	.75

Davenport, Ia.—City Engr. is reported to have prepared a plat of a sub-district in the northern part of the city. The sub-district as proposed will provide for sewering the entire district north of Locust St., bet. Brady and Farnam Sts.

**Hopkinsville, Ky.*—Robertson & Gardner, of Paducah, are stated to have secured the contract for constructing about 7 miles of sanitary sewers for the Hopkinsville Sewerage Co., for about $25,000.

**Portland, Me.*—The following are reported to be the bids opened on Aug. 23 by Geo. N. Fernald, Comr. Pub. Wks., for constructing Sect. 3 of the West Side intercepting sewer: Worster & Wilson, 92 Stevens Ave., $7,251 (awarded contract); Booth & Co., $9,875; C. E. Trumbell & Co., $9,336; Cefalo & Ferguson, $8,568; Forgione & Romano, $10,210; W. B. Bryne, $11,264, and J. J. Mahoney, $8,679.

Marion, Mass.—C. H. Delano, Town Clk., writes that the proposition to construct a system of sewers and a sewage disposal plant was defeated at the election on Aug. 25.

Crystal, Mich.—Robt. Munns, City Clk., writes that Engineer E. G. Bradbury is preparing plans for a sewerage system.

Rushford, Minn.—Bids will be received until Sept. 15 at the office of City Clk. C. O. Alm, for constructing 1,200 ft. sewer in Jessie St.

Rochester, Minn.—All bids opened on Aug. 18 for constructing a sewer on the east side are stated to have been rejected and new bids will be received. The lowest bid was that of Wm. O'Neil, of Faribault, for $19,844.

New Ulm, Minn.—Bids will be received by the City Council until Sept. 11 for furnishing material and constructing 9 blocks of sewer, as advertised in The Engineering Record.

Albert Lea, Minn.—C. E. Bainerd, City Clk., writes in regard to the sewer proposed from Spring Lake through Gilbert House Hill to Shell Rock River, that it will be of brick and cost about $20,000. An election will probably be held to vote on question, date not yet set.

Springfield, Minn.—Aug. G. Erickson, Village Recorder, writes that it is proposed to construct a sewer 900 ft. long, 3 x 4 ft., of concrete and cement or brick, to be used in the future as outlet of the sewerage system.

St. Louis, Mo.—Bids will be received until Sept. 13 by the Bd. Pub. Improv. for constructing the 13th St. sewer. Appropriation, $30,000.

Haddonfield, N. J.—Bids will be received by Allen Clymer, Boro. Clk., until Sept. 27 for the construction of about 2 miles of 8 to 12-in. pipe sewers, a sewage receiving well and about 2,000 ft. of c.-i. force main, as advertised in The Engineering Record.

Jersey City, N. J.—Bids will be received until Sept. 5 by the Bd. Street and Water Comrs. (Jas. S. Nolan, Chmn.) for constructing sewers in portions of Hudson Boule. and Sherman Pl. Approximate estimate of quantities: 1,100 lin. ft. 24-in. circular brick sewer; 400 lin. ft. 18-in. vitr. pipe sewer; 500 cu. yds. rock excav., etc.

Lestershire, N. Y.—Sewer bonds to the amount of $40,000 are reported sold.

Rochester, N. Y.—Ordinances were adopted by Council on Aug. 22 for the construction of sewers on Park Ave., Maria, Pansy and Cummings Sts.

Ballston Spa., N. Y.—Bids will be received until Sept. 7 by the Bd. Trus., at the office of Wm. H. Sherman, Village Clk., for constructing a sewage disposal plant, consisting of a receiving tank, pumping station, septic tanks, contact beds, etc.; estimated cost, $100,000. John M. Farley, Engr., White Plains.

Zanesville, O.—It is reported that bids will be received until Sept. 6 by the Bd. Pub. Service (H. W. Snoots, Secy.) for furnishing materials and constructing a storm sewer in Greenwood Ave.

Columbus, O.—Bids will be received until Sept. 25 by John T. Barr, Clk. Com. on Finance, for $18,000 southeast sanitary main sewer bonds.

**Steubenville, O.*—S. B. Curfman, City Engr., writes that Stitt & Kruse, of Wabash, Ind., have secured the contract for constructing a sewer in Adam St. at the following bid: 130 ft. 2-ring brick sewer, 36 in. diam., $5.75; 3,000 ft. 1-ring, 36-in. brick, $2.96; 150 ft. 18-in. pipe sewer, 95 cts.; 340 ft. 12-in., 53 cts.; 200 ft. 12-in. iron pipe, $1.40; 13 manholes, ea., $30, and 23 catchbasins, ea., $39; total, $11,317. Ferguson & Purcell, of Loraine, secured the contract for constructing sewer in Logan St., as follows: 125 ft. 2-ring, 36-in. brick sewer, $4.70; 2,150 ft. 1-ring, 36-in. brick sewer, $2.85; 120 ft. 18-in. pipe sewer, $1; 180 ft. 12-in., 90 cts.; 200 ft. 12-in. iron culvert pipe, $1.64; 9 manholes, ea., $35, and 15 catchbasins, ea., $37; total $8,195 (bids opened Aug. 21).

Salem, O.—Bids will be received by the Bd. Pub. Service (Geo. Holmes, Clk.) until Sept. 20, for furnishing materials and constructing sewers in portions of 10th and E. Green Sts., to consist of about 2,200 lin. ft. 8-in. sanitary sewer. B. M. French, City Engr.

Alliance, O.—Bids will be received until Sept. 5 by the Bd. Pub. Service (C. E. Harsh, Clk.) for constructing about 15,000 lin. ft. 6 and 8-in. sanitary sewers in portions of several streets and alleys.

**Cincinnati, O.*—McCarthy Bros. are stated to have secured the contract for constructing a sewer in Kinney Ave. for $8,067.

Bids will be received until Sept. 8 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and improving a portion of W. 8th St., by constructing sewers and drains; also Sept. 21 for improving Bloody Run, from Hopkins Ave. to Mill Creek, by constructing sewers and drains; estimated cost $190,905; bids will also be received until Sept. 22 for constructing sewers and drains in portions of 5 streets.

Lockland, O.—An election will probably soon be held to vote on issuing $80,000 bonds for a complete sewerage system and sewage disposal plant.

Ambler, Pa.—W. S. Acuff, of the Ambler Sewer Co., writes that it is proposed to expend $75,000 in the construction of a sewerage system, if franchise is secured from borough. The system will be of terra cotta pipe principally and the work will be done by the company.

Des Moines, Ia.—Bids will be received until Sept. 14 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for about 100,000 No. 1 repressed vitr. paving brick and about 250,000 sewer brick for the Ingersoll Run sewer.

Reading, Pa.—Bids will be received until Sept. 14 by the Bd. Pub. Wks. at the office of Chas. C. Weltmer, City Clk., for constructing about 279,300 lin. ft. 20, 15, 12, 10 and 8-in. pipe sewers; 240,300 lin. ft. 8, 6 and 5-in. connections, together with all the Y's and manholes in house sewer districts Nos. 3½, 4, 5, 6 and 11; also constructing about 2,450 ft. 54-in. house sewer main; total cost of sewers reported to be $845,000. Elmer H. Beard, City Engr.

Ft. McIntosh, Tex.—Bids will be received until Sept. 13 by Robt. R. Stevens, Ch. Q. M., U. S. A., San Antonio, for constructing an outlet for sewerage system at Ft. McIntosh.

Port Arthur, Tex.—Chas. D. Stillman, Secy. & Mgr. Port Arthur Sewer Co., writes that it is proposed to expend about $40,000, but no bids will be called for, as the company will do the work; the sanitary sewerage system will have a capacity for a population of 15,000.

Seattle, Wash.—Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., for sewers on 20th Ave., S and Atlantic Sts.; probable cost, $4,800.

**Watertown, Wis.*—E. B. Parsons, City Engr., writes that Elzy & Dunn, of Marshalltown, Ia., have secured the contract for constructing sewers (bids opened Aug. 29) at the following bid: 2,060 lin. ft. 18-in. sewer, $1.73; 704 lin. ft. 12-in., 85 cts.; 992 lin. ft. 10-in., 73 cts.; 3,205 lin. ft. 8-in., 65 cts.; 15 manholes, ea. $40, and 6 automatic flush tanks, ea. $75; total, $7,995. The other bids received were from O'Shea & Shea, Hammond, Ind., $11,001, and E. L. Bartlett, Watertown, $10,066.

Fond du Lac Wis.—F. A. Bartlett City Clk. writes that it is proposed to construct a system of storm sewers, at a probable cost of $50,00. G. H. Stanchfield, City Engr.

Rhinelander, Wis.—Bids will be received until Sept. 9 for constructing sewers; Gust. Swedberg, City Clk.

Appleton, Wis.—Bids will be received until Sept. 6 by E. L. Williams, City Clk., for constructing a sewer in State Road.

**Sheridan, Wyo.*—Jas. Kennedy, of Fargo, is reported to have secured the contract for constructing a sewerage system here (bids opened Aug. 21) for about $70,000.

Niagara Falls, Ont.—Bids are wanted until Sept. 11 for $10,022 bonds for sewer purposes; also $6,962 bonds for permanent walk purposes; John Robinson, City Clk.

BRIDGES.

Notes Arranged Alphabetically by States.

Weaverville, Cal.—It is stated that bids will be received until Sept. 8 by R. L. Carter, Co. Clk., for constructing a wagon bridge across East Fork of Trinity River.

Hartford, Conn.—Bids will be received at the office of the Bridge Comn. until Sept. 19 for about 5,000 cu. yds. rubble granite walls, as advertised in The Engineering Record.

Washington, D. C.—Bids will be received by Col. R. L. Hoxie, Corps Engrs., U. S. A., until Sept. 25, for constructing a concrete-steel bridge over Washington Channel, in approach to highway bridge across Potomac River, as advertised in The Engineering Record.

Moscow, Idaho.—It is stated that bids will be received until Sept. 11 by the Co. Comrs. for constructing 3 bridges across Paradise Creek. A. P. Ramsteadt, Clk.

Monticello, Ind.—It is stated that bids will be received until Sept. 6 by the Co. Comrs. for constructing and repairing bridges throughout the county. J. L. Ackerman, Co. Aud.

South Bend, Ind.—The Bd. of Co. Comrs. have employed A. J. Hammond, of South Bend, to prepare plans for the concrete substructure and superintend the removal of the Jefferson St. truss bridge to Springbrook Park. The bridge consists of 3 spans, total length 492 ft.; estimated cost $27,000. John W. Harbon, Co. Aud.

New Albany, Ind.—It is reported that bids will be received until Sept. 8 at the office of Thos. Hanlon, Aud., for constructing 2 bridges, one at Wheelers Ford, Lafayette Township, and the other at Georgetown.

Crawfordsville, Ind.—It is reported that bids will be received until Sept. 5 by the Bd. Co. Comrs. (A. T. Hornbaker, Chmn.) for constructing 2 steel bridges and 2 concrete abutments in this county.

Leavenworth, Kan.—It is reported that bids will be received until Sept. 6 at the office of M. A. Przbylowicz, City Clk., for constructing a steel I-beam bridge with concrete abutments at 8th and Shawnee Sts.; probable cost, $5,874.

Bermuda, La.—Bids will be received until Oct. 3 by the Police Jury of Natchitoches Parish at Natchitoches, for constructing a steel bridge across Cane River at Bermuda.

**Concord, Me.*—Engr. E. E. Greenwood, of Skowhegan, writes that the following are the bids opened by the Comrs. of Somerset County on Aug. 21 for a steel highway bridge across Kennebec River, bet. Bingham and Concord: (*a*) superstructure, 2 unequal spans, 300 and 177 ft.; (*b*) superstructure, 2 spans, 215 ft. ea.; (*c*) superstructure, single span, 432 ft.: Eastern Bridge & Structural Co., Worcester, Mass., *a* $24,500, *b* $20,600, *c* $29,300; Canton Bridge Co., 147 Milk St., Boston, Mass., *b* $18,823; Louis F. Shoemaker, New Haven, Conn., *b* $29,285; Massillon Bridge Co., Toledo, O., *b* $19,245; Boston Bridge Wks., 47 Winter St., Boston, Mass., *a* $20,406, *b* $16,816, *c* $29,292; American Bridge Co., 291 St. John St., Portland, Me., *a* $21,800 (awarded contract), *b* $20,300, *c* $29,266.

**Boston, Mass.*—The following are the bids opened on Aug. 21 by the Metropolitan Park Comn. (J. R. Rablin, Engr.) for building Granite Branch Bridge, Furnace Brook Parkway: (*a*) Globe Constr. Co., (*b*) Patk. McGovern, (*c*) D. F. O'Connell Co., (*d*) John Cashman, Quincy (awarded contract). (Bidders of Boston, unless otherwise mentioned):

	a	*b*	*c*	**d*
3,500 cu. yds. earth grading	$.79	$.85	$.40	$.50
1,000 cu. yds. concrete masonry	7.34	6.50	7.00	6.50
150 cu. yds. 1st class stone masonry	29.52	30.00	32.00	40.00
1 reinforced concrete arch 46-ft. span	4132.00	4300.00	5000.00	4000.00
228 lin. ft. stone coping	5.70	5.50	5.50	3.50
105 lin. ft. concrete edgestone	1.20	.75	1.10	1.25
200 sq. yd. granolithic walks	2.04	1.50	2.52	2.50
25 sq. yds. cobble stone gutters	.54	1.00	.55	1.25
120 cu. yds. loam surfacing	1.25	1.50	1.50	1.25
Totals	$20,663	$20,613	$20,267	$19,860

Hyde Park, Mass.—Two steel foot bridges are to be constructed over Neponset River, at Glenwood Ave., one 63 ft. long, to be constructed by the town; the other 80 ft. long, to be constructed by the New York, New Haven & Hartford R. R. Co. (Colin M. Ingersoll, Ch. Engr., New Haven, Conn.). C. G. Norris, Town Engr.

Minneapolis, Minn.—Andrew Rinker, City Engr., writes that the Washington Ave. Bridge will probably be widened this coming winter. Definite plans have not yet been decided upon.

New Brunswick, N. J.—Bids will be received by the Bd. Chosen Freeholders (A. Fountain, Dir.) until Sept. 6, for strengthening and reinforcing the superstructure of the county bridge at Weston's Mills, East Brunswick Township; Arthur O'Neil, Chmn. Bridge Com.

Brooklyn, N. Y.—The following are the bids opened on Aug. 24 by the Park Comrs., N. Y. City, for furnishing material and altering and repairing Terrace Bridge in Prospect Park, Brooklyn Boro.: Cooper & Evans, 220 Bway, N. Y. City, $15,879, and Bart Dunn, 253 E. 68th St., N. Y. City, $16,304.

Upper Sandusky, O.—Bids will be received until Sept. 19 by J. N. Traxler, Co. Aud., for furnishing material and constructing a stone or concrete substructure and steel superstructure for bridge across Tymochtee Creek in Salem Township, 106 ft. span and 16 ft. roadway. Bids on superstructure and substructure to be submitted separately.

Circleville, O.—Bids will be received until Sept. 11 by the Bd. Co. Comrs., for constructing an arch culvert over Pumpkin Run on the Circleville and Kingston Turnpike. N. C. Bohnert, Co. Aud.

New Philadelphia, O.—Bids will be received until Sept. 15 by the Bd. Co. Comrs., for constructing 2 bridge abutments, one for a bridge at Walnut St. and the other at 15th St., in the Dover Land Improvement's addition to Canal Dover. A. V. Donahey, Co. Aud.

Delaware, O.—J. S. Dike, City Engr., writes that bids will be opened on Sept. 15, not Sept. 7, as previously stated, by the Bd. Pub. Service (F. D. King, Clk.) for furnishing material and constructing a bridge over Delaware Run on Sandusky St.

Portland, Ore.—It is stated that the Consolidated St. Ry. of this city will change its route to Vancouver and will build a two-span bridge to Shaw's Island, from which place the ferry will start for Vancouver. The estimated cost of the improvements is $100,000.

Wilkesbarre, Pa.—The City Council is reported to be considering the construction of overhead bridges over railroads, at an estimated cost of $80,000.

**Georgetown, Tex.*—The County Comrs. are stated to have awarded the contract for constructing 3 bridges over streams in Williamson County to C. I. Horton, of Austin, for $19,200.

Port Orchard, Wash.—It is stated that bids will be received until Oct. 2 by the Co. Comrs. for constructing a bridge 480 ft. long, with lift draw. R. S. Hayward, Co. Aud.

Spokane, Wash.—Chas. McIntyre, City Engr., writes that the matter of constructing a bridge over the third channel of Spokane River at Howard St. is under consideration, but is at present merely in its preliminary stages of discussion.

**Items marked thus give the names of parties awarded contracts.*

Racine, Wis.—The Bd. of Pub. Wks. is stated to have opened on Aug. 17 bids for furnishing material and removing the substructure and superstructure of the present Root River Bridge and constructing a new swing bridge and approach as follows: American Bridge Co., $75,473; Milwaukee Bridge Co., plan B, $73,600; Worden-Allen Co., $68,432; Wisconsin Bridge & Iron Co., Milwaukee, $64,440, and $65,597 (awarded contract).

Eau Claire, Wis.—Bids for constructing abutments for the Madison St. Bridge are stated to have been received as follows: Wm. S. Hewett & Co., $4,475, and Lang & McAnulty, $4,700.

Milwaukee, Wis.—See "Miscellaneous."

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

**Little Rock, Ark.*—J. P. Shelby & Co., of Pine Bluff, are stated to have received the contract for paving with Pittsburg block on a portion of Center St. for $35,892.

Bids will be received by the Bd. Pub. Affairs (Herbert Der Val, Clk.) until Sept. 23, for resurfacing with asphalt and repairing portions of W. Markham St.

Denver, Colo.—The Bd. of Pub. Wks. is stated to have opened bids Aug. 21 as follows for paving with asphalt Welton St.: Denver & Pueblo Constr. Co. $43,041; Colorado Paving Co., $37,398, and the Colorado Co., $41,596.

New Britain, Conn.—The town of New Britain has voted an appropriation of $9,000 for macadam roads.

**Morris, Conn.*—Rossi & Mascetti, of Torrington, are stated to have received the contract for grading a section of highway in Morris for $4,400.

**Wilmington, Del.*—The Street and Sewer Comrs. are stated to have awarded on Aug. 22 the contract for paving with asphalt about 5,000 sq. yds. to the Filbert Paving & Constr. Co., of Philadelphia, Pa., at $1.85 per sq. yd.

The following are the bids opened on Aug. 29 by Francis A. Price, County State Highway Comr., at Wilmington, for constructing 2½ miles of the Hare's Corner Road, from Farmhurst to Hare's Corner; Theobold Harsch, Narbeth, Pa., $18,437; Christiana Constr. Co., $20,982, and Stewart & Donohue, $20,747.

Highway Comr. F. A. Price is stated to have presented to the Levy Court on Aug. 29 a report estimating the cost of building a macadam bed to Faulk Road at $15,000, and he was authorized to secure bids for this road.

**Ft. De Soto, Fla.*—Lieut. Raymond S. Pratt, Q. M., U. S. A., writes that the contract for constructing brick roads and concrete sidewalks at this post has been awarded to H. Walter Fuller, Bradentown, Fla., for $22,750.

Ft. Madison, Ga.—The City Council is stated to have passed an ordinance providing for the paving with macadam on 3d and 4th Sts.

Boise, Idaho.—It is stated that bids will be received until Sept. 9 at the office of the Governor for constructing about 27 miles of wagon road.

Brazil, Ind.—Bids will be received until Sept. 14 by the Bd. Co. Comrs. for constructing the Jack Loveall Free Gravel Road in Dists. Johnson and Van Buren Townships; J. Frank Smith, Co. Aud.

Washington, Ind.—It is stated that bids will be received until Sept. 9 by the Co. Comrs. for constructing an extension to the free gravel and macadamized roads in Madison Township. Thos. Nugent, Co. Aud.

Brownstown, Ind.—It is stated that bids will be received until Sept. 15 by the Co. Comrs. for constructing gravel roads in Grassy Fork Township about 4 miles in length; also for constructing about 5 miles of gravel road in Washington Township. H. W. Wacker, Co. Aud.

Indianapolis, Ind.—Bids will be received until Sept. 6 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for grading and paving a portion of an alley with brick; improving a portion of Ella St., by grading, graveling and rolling the roadway; also Sept. 13 for grading a portion of Tuxedo St. with creosoted wooden block, grading, graveling and rolling the roadway and paving the sidewalk with cement on a portion of Oakland Ave.; grading and paving the sidewalks with cement on portions Beville Ave., Buchanan and Oxford Sts.

South Bend, Ind.—Estimates have been filed for 17,000 sq. ft. cement walks and 4,000 ft. curb.

Specifications have been adopted by the Bd. of Pub. Wks. (W. A. McInerney, Pres.) for brick paving in Tutt St. and several alleys, in all about 2,000 sq. yds.

**La Salle, Ill.*—The contract for paving and improving St. Vincents Ave. is reported to have been awarded to T. W. Keys and W. T. McNamara for $25,654.

**Belvidere, Ill.*—S. Vanderwalker is stated to have received the contract for macadamizing 1st and Pearl Sts. for $14,272.

Peoria, Ill.—It is stated that the City Engr. has been authorized to prepare estimates for the paving of a portion of Adams St.

The Bd. of Pub. Improv. is stated to have decided to pave a portion of Hamilton St. with brick, at an estimated cost of $6,527.

Chicago, Ill.—David Robertson, 184 La Salle St., is stated to have prepared plans for a 3-story, 40 x 80-ft. asphalt plant, to be erected at 59 Dix St., for the Parker-Washington Co., at a cost of $25,000.

The following are the bids opened on Aug. 24 by Jos. M. Patterson, Comr. Pub. Wks., for paving Randolph and Van Buren St. bridges with creosoted block (price given per sq. yd.): Parker-Washington Co., $4.45; F. F. Gross, $3.45, and R. F. Conway Co., $2.60.

Sterling, Ill.—John D. Arey, City Engr., writes that it is proposed to pave with brick W. 4th St. and Aves. A and B, at a cost of $29,000.

**Elgin, Ill.*—The contracts for paving S. State and W. Chicago Sts. (bids opened Aug. 25) have been awarded as follows: To A. E. Price, of Elgin, for 969 sq. yds. brick and 2,376 sq. yds. macadam for $4,892, and to Thos. J. Peter Co., 135 Adams St., Chicago, for 4,193 sq. yds. brick at $7,686.

Waukegan, Ill.—Bids will be received until Sept. 8 by Bd. Local Improv. for grading, curbing and paving with 3-in. crushed granite on a 9-in. crushed limestone, about 4,430 sq. yds. on Utica St. and on Hickory, 1st, 2d, 3d Sts. and North Ave. in all about 10,865 sq. yds., as advertised in The Engineering Record.

Atchison, Kan.—The City Council on Aug. 18 passed resolutions for paving as follows: 8th St., 4,184 sq. yds. brick paving and 1,460 lin. ft. curb; L St., 1,931 sq. yds. brick paving and 1,370 lin. ft. curb, and Commercial St., 9,500 sq. yds. macadam and 5,360 lin. ft. curb.

Towson, Md.—Bids will be received until Sept. 7 by the Highway Comrs. for grading and macadamizing about 1 mile road; H. G. Shirley, Roads Engr.

Rockville, Md.—Bids will be received until Sept. 12 by the Bd. Co. Comrs. (Robt. G. Hilton, Clk.) for macadamizing about 1 mile of road between Rock Creek and Norbeck.

Everett, Mass.—Bids will be received until Sept. 5 by the Bd. Pub. Wks. (Geo. S. Marshall, Chmn.) for paving Main St. Bids to include a 5-year maintenance guarantee.

**Boston, Mass.*—The following are the bids in detail opened on Aug. 21 by the Metropolitan Park Comn. (J. R. Rablin, Engr.) for grading Quincy Shore Reservation from Atlantic St. to National Soldiers' Home, Quincy (bidders of Boston, unless otherwise mentioned): (*a*) T. E. Ruggles, (*b*) Globe Constr. Co., (*c*) Jones & Meehan, (*d*) Eastern Dredging Co., (*e*) Coleman Bros., (*f*) Wm. H. Ellis, (*g*) T. H. Gill & Co., (*h*) Rowe & Perini, South Framingham, (*i*) Hewell & Snowling Constr. Co., Uxbridge (awarded contract):

	2,500 cu. yds. earth grading.	175,000 cu. yds. filling.	10 M. ft. spruce.	Total.
a	$.40	$1.25	$45.00	$220,200
b	.35	.79	40.00	139,525
c	.30	.78	45.00	137,700
d	.30	.68	35.00	120,100
e	.50	.59	40.00	104,900
f	.39	.58	40.00	102,875
g	.25	.52	25.00	91,875
h	.35	.44	50.00	78,375
**i*	.26	.37	30.00	65,700

Boston, Mass.—All bids opened Aug. 24 by the Massachusetts Highway Comn. (W. E. McClintock, Chmn.) for constructing highways in the towns of Lincoln, Beverly, Lancaster and Sterling, Mass., are stated to have been rejected.

**Muskegon, Mich.*—Adam Thompson, of Chicago, Ill., is stated to have received the contract for paving with asphalt Sanford and Walnut Sts. at $1.74 and $1.64 per sq. yd. respectively.

Niles, Mich.—It is reported that bids will be received until Sept. 6 by Carl Whetstone, City Clk., for paving 4th St. with brick.

**Chillicothe, Mo.*—J. E. Meek, of Chillicothe, is stated to have received the contract for paving a portion of N. Locust St. for $4,165.

Macon, Mo.—C. J. Du Bois, City Engr., writes that bids will be received in Sept. for 12,000 sq. yds. brick paving.

Helena, Mont.—It is stated that bids will be received by the Co. Comrs. until Sept. 9 for constructing 2 wagon roads in Blackfoot Valley, in the vicinity of Lincoln. Percy R. Witner, Co. Clk.

**South Omaha, Neb.*—Johnson & Parks are stated to have received the contract for repaving a portion of 24th St. at $1.95 per sq. yd.

Washington, N. C.—Bids will be received until Sept. 11 by the Bd. Aldermen for vitrified brick pavement, in all about 5,000 sq. yds. paving and 2,700 ft. stone curbing, catch basins and accessories. Jas. S. Hall, Engr., Washington.

West Orange, N. J.—Press reports state that bids will be received until Sept. 5 by the Town Council for grading and macadamizing New Valley Road.

Brooklyn, N. Y.—Bids will be received until Sept. 13 by Martin W. Littleton, Boro. Pres., for regulating, grading, curbing, paving and repaving portions of 11 streets. Engineer's estimate: 64,405 sq. yds. asphalt; 10,815 cu. yds. concrete; 20,130 lin. ft. new curb; 2,500 lin. ft. new curb to be set in concrete; 11,830 lin. ft. old bluestone curb to be reset; 111,030 sq. ft. cement sidewalks; 164 noiseless covers and heads complete for sewer manholes, etc., Boro. Brooklyn.

**Troy, N. Y.*—The contract for regulating, grading, curbing and paving a portion of N. 1st St. with brick is stated to have been awarded to P. A. Lillis at $2.66 per sq. yd. and $98 each for catch basins.

Albany, N. Y.—Bids will be received until Sept. 5 by the Bd. Contract and Supply (Isidore Wachsman, Clk.) for grading, curbing and paving portions of 7 streets with vitr. blocks.

Johnstown, N. Y.—The Council on Aug. 23 adopted plans for paving S. Perry St., 1,800 sq. yds., and Market St., 10,000 sq. yds., with asphalt block. Further action will be taken on this paving Sept. 4. J. F. Campbell, City Engr.

Rensselaer, N. Y.—Bids will be received until Sept. 5 by the City Clk. for grading, curbing and paving with macadam a portion of Riverside Ave.

Rochester, N. Y.—The Common Council is stated to have passed ordinances providing for constructing cement walks on West and Ames Sts.; also for paving Mortimer and Franklin Sts.

*H. B. Hooker & Son, Wilder Bldg., are stated to have received the contract for paving Mason St. with macadam for $9,606.

**Marion, O.*—Wm. Fies, City Clk., writes that contracts for paving (bids opened Aug. 23) have been awarded as follows: to Drake & Son, of Marion, for paving Silver St. with Logan block, for $10,644, and to the Barber Asphalt Co., for asphalt paving on Church and Main Sts., for $29,691.

**Cleveland, O.*—The Bd. Pub. Service is stated to have awarded the contract for grading and paving a portion of Edgewater Boule. to Spence Bros., 2923 Euclid Ave., for $27,167.

Madisonville, O.—Separate bids will be received until Sept. 22 by J. A. Conant, Village Clk., for furnishing per cu. yd. material delivered on the streets, including spreading, sprinkling and rolling; also separate bids for per cu. yd. material only, f. o. b. Madisonville. Estimate of quantities: 2,579 cu. yds. stone; 750 cu. yds. fine crushed stone or screenings, and 36,000 sq. yds. sprinkling and rolling.

Cincinnati, O.—All bids opened on Aug. 14 for paving Warsaw Ave. with bitulithic have been rejected.

*M. T. Flynn, Chase Ave. and Dane St., is stated to have received the contract for paving with granite a portion of E. 12th St., at $8,439.

Ottawa, O.—O. C. Talbot, County Surv. and Engr., writes that bids will be received until Sept. 16 for 10¼ miles of stone road; estimated cost $43,754.

Kennedy Heights, O.—Bids will be received until Sept. 23, by H. H. Grant, Clk., Village Kennedy Heights, at the office of O. W. Bennett, 307 Carlisle Bldg., Cincinnati, for $2,500 sidewalk improvement bonds.

East Palestine, O.—Bids will be received until Sept. 5 at the office of J. W. Knaub, Village Clk., for furnishing materials and paving a portion of Main St. Also same date for $20,000 bonds for paving said street.

Ashland, O.—It is stated that bids will be received until Sept. 8 by C. W. Carver, Township Clk., for macadamizing and piking a road.

Napoleon, O.—It is stated that bids will be received until Sept. 18 by F. J. Beck, Co. Aud., for constructing a road in Napoleon Township.

Lima, O.—It is stated that bids will be received until Sept. 18 by the Bd. Pub. Service for paving with vitrified brick on S. Main St., 1,900 sq. yds., and for cement curbing on N. Main St., 4,300 lin. ft. O. J. Rose, City Clk.

Steelton, Pa.—Bids will be received by John D. Young, Secy. Boro. Council, until Oct. 4, for paving Front St., about 31,500 sq. yds. with asphalt, creo-resinate wooden block, vitrified brick or any other approved material, on a 6-in. concrete base, as advertised in The Engineering Record. Specifications for this work are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y.

**Olyphant, Pa.*—D. E. Nicholls & Co., of Scranton, are stated to have received the contract for paving with brick Delaware St., at $2.18 per sq. yd.

**Collingdale, Pa.*—The contract for grading and macadamizing a portion of Springfield Road is stated to have been awarded to J. G. Nealon, of Darby, at 68 cts. per sq. yd.

**Pittsburg, Pa.*—The County Comrs. are stated to have awarded the contract for macadamizing about 2 miles of the Boston Road extension to W. E. Howley, Bijou Bldg., for $20,066.

**Uniontown, Pa.*—Chas. F. Kefover, Boro. Solicitor, writes that the Uniontown Constr. Co., of Uniontown, has secured the contract for paving E. Fayette St. (bids opened Aug. 21) at 58½ cts. for paving 3,860 sq. yds. with brick; 58½ cts. per lin. ft. for curb, and 40 cts. per. cu. yd. for grading. The Layton Fire Clay Co., of McKeesport, secured the contract for furnishing the vitr. clay brick for this pavement, 232,000, at $10.55 per M.

Bids will be received by Chas. F. Kefover, Boro. Solicitor, on Sept. 4 for paving N. Vernon St. with brick, the contractor to furnish all material except the brick. Separate bids will be received for the brick, about 670,000 vitrified paving brick.

Harrisburg, Pa.—It is reported that bids will be received until Sept. 11 by the Highway Comr., for paving 4th and Reilly Sts.

Brooklyn, N. Y.—The following are the bids opened on Aug. 24 by the Park Comrs., N. Y. City, for regulating, grading and paving with asphalt on concrete foundation Pitkin Ave., between Stone Ave. and Eastern Parkway extension, Brooklyn Boro.: (*a*) The Barber Asphalt Paving Co., 114 Liberty St., New York; (*b*) Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., Brooklyn; (*c*) Cranford Co., 52 9th St., Brooklyn; (*d*) Uvalde Asphalt Paving Co., 1 Bway, New York:

	a	*b*	*c*	*d*
20,677 sq. yds. completed asphalt pav't., including binder course	$0.74	$0.75	$0.74	$0.81
2,878 sq. yds. concrete found	3.95	3.75	3.15	3.75
2,252 lin ft. furnish and set new curb	.65	.50	.80	.77
5,000 lin. ft. reset, rejoint, etc., old curb	.31	.40	.30	.30
86 noiseless covers and heads for sewer manholes	14.00	15.00	15.00	15.00
3,904 yds. earth excav	.01	.20	.25	.20
30,000 sq. ft. cement sidewalks	.14	.16	.15	.14
Total	$35,126	$36,297	$34,434	$37,046

**Seattle, Wash.*—The following are the totals, also unit prices of some of the items on bids opened on Aug. 19 by the Bd. of Pub. Wks. for concrete walks on Northlake Ave. (bidders all of Seattle): (*a*) International Contract Co., $58,077; (*b*) Coast Concrete Co., $57,091; (*c*) Thorsvig & Lindland, Pacific Blk., $53,891 (awarded contract); (*d*) Sparger Concrete Co., $63,225; (*e*) Hans Pederson, $57,815; (*f*) D. Dow & Co., $57,104, and (*g*) Paul Wagner & Co., $59,994:

	a	*b*	**c*	*d*	*e*	*f*	*g*
Fixed estimate	$3000.00	$3000.00	$3000.00	$3000.00	$3000.00	$3000.00	$3000.00
6,300 cu. yds. earthwork	.20	.12	.10	.15	.01	.10	.25
205 M. ft. B. M. crosswalks, landings, etc.	13.50	14.00	14.00	15.00	14.00	15.50	15.00
46,540 sq. yds. concrete sidewalks	.96	.96	.88	1.05	.99	.94	.97
7 catch basins, single inlet	60.00	55.00	65.00	65.00	65.00	65.00	65.00
15,000 lin. ft. 3-in. sewer pipe	.10	.10	.12	.12	.04	.12	.10
1,120 lin ft. 12-in. pipe sewer	1.80	1.30	1.40	2.00	1.10	1.50	2.00
105 M. ft. overhead crossing, lumber	14.50	15.00	16.00	18.00	25.00	16.00	18.00
1,050 lin. ft. railing	01	.15	.10	.15	.20	.15	.20
23 cu. yds. concrete	7.00	6.00	10.00	7.50	7.00	7.00	7.50

**Items marked thus give the names of parties awarded contracts.*

Harrisburg, Pa.—The following are reported to be the lowest bids for constructing roads: Whitehall Rd., A. Davis, of Ambler, $19,027; Skipnack Rd., John McMenamy, $20,188; Lower Providence Rd., McCormick & Co., $24,450.

Memphis, Tenn.—Bids will be received by the Bd. Fire and Police Comrs. at the office of W. B. Armour, City Register, until Sept. 7, for paving a portion of Main St., consisting of about 21,000 sq. yds. of asphalt, tearing up and relaying about 21,000 sq. yds. of old granite block, tearing up and hauling about 24,000 sq. yds. of old brick pavement, laying about 3,000 sq. yds. of new granite blocks; also for improving Shelby St. by relaying graite blocks removed from Main St., laying new granite pavement, and removal of present brick pavement.

Salt Lake City, Utah.—The City Council is reported to have published a notice of intention to pave 4th St., from W. Temple to 2d Sts., and State St., from 4th to 7th S. Sts.; estimated cost, $130,225.

Spokane, Wash.—The Bd. Pub. Wks. is stated to have recommended the paving of a portion of Mill St., at a cost of $10,107; also 2d Ave. and Bernard St., at a cost of $12,493 and $24,625 respectively.

Tacoma, Wash.—The Comr. of Pub. Wks. is stated to have opened on Aug. 22 bids for paving with asphalt N. 6th and N. 8th Sts., as follows: Barber Asphalt Paving Co., $6,870, and Geo. M. Savage Co., $8,300.

Seattle, Wash.—Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., for grading and curbing 26th Ave. N. at a cost of $10,900 and grading McGraw St. at a cost of $14,400.

*The Seattle Stone Co. has secured the contract for sandstone block paving on Warren Ave. for $4,275 and the International Contract Co. for concrete sidewalks on 29th Ave. S. for $5,770.

Green Bay, Wis.—It is reported that bids will be received until Sept. 12 by the Com. on Streets and Bridges (W. E. Duncan, Chmn.) for furnishing materials, grading and macadamizing a portion of 11th St.

Niagara Falls, Ont.—See "Sewerage and Sewage Disposal Plants."

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Troy, Ala.—The Troy Gas Co. has filed articles of incorporation with a capital of $50,000. Incorporators: W. H. Samford, F. S. Wood, of Troy; H. L. McKee, of Meridian, Miss., and others.

Los Angeles, Cal.—The Yuma Electric & Water Co. is reported incorporated, with a capital of $100,000, by A. A. Talmage, H. W. Blaisdell, and others.

Anaheim, Cal.—Clem. A. Copeland, of Los Angeles, is stated to have estimated the cost of improvements to the electric light plant at $22,000, and to the water works $18,250. An election will soon be held to vote on the question of issuing bonds for same.

**San Luis Obispo, Cal.*—B. F. Thomas, Mgr. San Luis Obispo Gas & Electric Co., writes that the C. C. Moore Co., of San Francisco, has secured the contract for constructing a new plant of 270-kw. capacity. Engineer, A. M. Hunt, 614 Mission St., San Francisco.

Washington, D. C.—Bids will be received until Sept. 12 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Dynamos; electric drills and supplies; insulation of electric lights, etc.; engine, pipe and fittings; steel conduit and fittings; cable; cylinder; copper, sheet bar and tool steel, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Jacksonville, Fla.—Bids will be received until Oct. 4 by the Bd. Trus. of the Water Wks. and Improv. Bonds for furnishing and setting in place on foundation furnished by the Bd. at the electric light station two 500-kw. steam turbo-generators, a steam-driven exciter set and switch panels; turbines to be run condensing, steam pressure at boilers 150 lbs., no superheat, 27 in. of vacuum; generators to be of the revolving field type, 3-phase, 60 cycles, 2,300 volts. Blue prints and specifications are to be furnished with bids. R. N. Ellis, Supt.

Savannah, Ga.—The City Council on Aug. 18 passed the ordinance granting a franchise to the Savannah Lighting Co.

Blackfoot, Idaho.—E. W. Wade, of Ogden, and Christian Just, of Blackfoot, are reported interested in the construction of a power plant on Blackfoot River, to supply Idaho Falls, Blackfoot and other cities, with electric light and power; probable cost of plant, $100,000.

Freeburg, Ill.—Chas. Kessler, Village Clk., writes that the proposed municipal electric light plant will cost about $9,000. No engineer selected as yet.

**Morris, Ill.*—Frank S. Moses, of Trenton, N. J., it is stated, has secured the contract to construct a gas plant here at $50,000.

Belleville, Ill.—It is reported that the City Council has appointed electrical engineers to prepare estimates of the proposed municipal electric lighting plant.

**Chicago, Ill.*—It is reported that a contract has been secured by the Stanley Electric Mfg. Co., of Pittsfield, Mass., to furnish arc lamps for the Seaside Park in Chicago. Cost, $20,000.

Bids will be received until Sept. 8 by Wm. Carroll, City Electrician, for furnishing to the Dept. of Electricity the following supplies: 1,500 or more cedar poles, 6-in. tops; 1,500 cross arms; 3,000 cross-arm braces; 3,000 locust pins; 5,000 lag bolts; 5,000 washers; 10,000 pole steps; 10,000 triple petticoat glass insulators and 100 miles of No. 6 triple braid weatherproof electric light wire.

Dana, Ind.—Bids will be received until Sept. 9 for the construction of an electric light plant, power and building, as advertised in The Engineering Record. Bids will be received for both direct current and alternating current and will be received on the plant as a whole or on separate items. G. W. Sturm, Town Clk.

Geneva, Ind.—W. R. Thurston, of Bern, is reported to have petitioned the Town Bd. for a franchise to construct a power plant at Geneva.

Van Buren, Ind.—The Huntington Light & Fuel Co., of Huntington (F. D. Townsend, Supt.), it is reported, has petitioned City Council for a franchise for the erection and operation of an electric light plant in this city.

Herington, Kan.—Chas. F. Gustafson, of Topeka, it is stated, has secured a franchise to furnish water, electric light and power to Herington.

**Bangor, Me.*—The Stanley Electric Mfg. Co., of Pittsfield, Mass., it is reported, has closed a contract with the Bodwell Water Power Co., of Bangor, for eight 1,000-kw. generators and necessary switchboards, the cost to be about $75,000.

Baltimore, Md.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 27, for the installation complete of the conduit and electric wiring system for the U. S. Custom House at Baltimore, as advertised in The Engineering Record.

Rose City, Mich.—Jas. Monaghan and Frank G. Bell are stated to have secured a franchise to install a commercial lighting plant.

Holland, Mich.—Jos H. Brewer and Hugh Blair,. of Grand Rapids, are reported to have decided to purchase the plant of the Holland Gas Co., and will expend $25,000 in pipe-line extension improvements to the plant.

Florence, Mich.—A. E. Edmonds and a party of Rhinelander capitalists, it is reported, will construct a power plant near here and will supply the cities of Florence and Crystal Falls with light and operate an interurban line from Iron Mountain to Spread Eagle Lake.

Pontiac, Mich—Engineers McKean, Ball & Co., of Chicago, Ill., write that the general contract for constructing the plant of the Clinton River Power Co. has already been let, but wire and supplies and arc lamps are yet to be purchased.

Ft. Snelling, Minn.—Bids will be received until Sept. 8 by R. M. Schofield, Constr. Q. M., U. S. A., St. Paul, for constructing an addition to electric system at Ft. Snelling.

Mount Iron, Minn.—This village is reported to have voted to install an electric light plant.

Marshall, Minn.—It is reported that the Marshall Heating Co. will install a central heating station.

Perth Amboy, N. J.—The City Council has granted a franchise to the Citizens' Electric Light & Power Co. The company will probably begin work on its plant at once. Engineers, Runyan & Carey, 122 Market St., Newark.

Silver City, N. M.—Geo. T. Schmelzel writes in regard to the proposed electric light plant for Silver City, that it will cost $9,000. The plant will be purchased in open market. Address, Geo. T. Schmelzel, at Hotel Brevoort, Chicago, Ill., for 10 days after Sept. 1.

**Stillwater, N. Y.*—Flood & Sherrill, of Sandy Hill, it is stated, have secured the contract to construct a concrete dam across the Hudson River at Stillwater, at a cost of about $16,000. About 600 to 800 cu. yds. of rock will be excavated. The dam is to provide power for the Hudson Valley Ry. and to the mills.

Youngstown, O.—Press reports state that a combination of the railway and lighting companies in and near Youngstown, is to be known as the Mahoning & Shenango Ry. & Light Co.; it will have a capital of about $10,000,000, and control about 30 corporations. Murray A. Verner, of Pittsburg, Pa., is reported interested.

**York, Pa.*—Sanderson & Potter, of New York, N. Y., are reported to have secured the contract for constructing a dam 32 ft. high, to contain about 375,000 cu. yds. concrete masonry, on Susquehanna River, for the McCalls Ferry Power Co.

Sioux Falls, S. D.—The Queen City Electric Light & Power Co. has been incorporated at Pierre with a capital of $300,000. Incorporators: H. J. Hanford, Chicago, Ill.; P. Curtis, Norwalk, O.; W. G. Mack, of Sioux Falls, and others.

**Pluma, S. D.*—Phillips & Bartlett, of Deadwood, are stated to have secured the contract for erecting a power house at Pluma, for the Consolidated Power & Light Co.; probable cost, $20,000.

Utica, S. D.—The Utica Gas Co. is reported formed to install a gas plant at Utica.

Knoxville, Tenn.—The Bd. of Pub. Wks. (W. M. Epps, Chmn.), it is stated, will receive bids about Sept. 11 for lighting the streets of the city.

Richfield, Utah.—A. J. Paulson, of Richfield, is stated to have filed with the State Engr., at Salt Lake City, an application for a water right on Sevier River. It is proposed to install a power plant, capable of developing 450 hp.

Ogden, Utah.—L. B. Spencer, of Ogden, is stated to have filed with the State Engineer, at Salt Lake City, an application for a water right on Ogden River, his intention being to construct a power plant to furnish both power and light in Ogden.

Readsboro, Vt.—The Deerfield River Power Plant Co. has been organized to construct a power plant on Deerfield River, near Readsboro, just across the Massachusetts State line. Incorporators: W. S. Morton, Hartford, Conn.; Jas. H. Roraback, of Canaan, and Faxon Bowen, of Readsboro.

Ft. Myer, Va.—Bids will be received by Capt. A. W. Butt, Q. M., U. S. A., Washington, D. C., until Sept. 18, for constructing an addition to the electric lighting system at the Signal Corps Post, Ft. Myer, as advertised in The Engineering Record.

Norfolk, Va.—Articles of incorporation have been filed by the Masons of this city with a capital of $50,000, for the purpose of erecting a Masonic hall at the Jamestown Exposition. The officers of the company are C. P. Breese, Pres.; J. St. Clair, Vice-Pres., and Col. Harry Hodges, Treas.

Sunnyside, Wash.—The question of constructing water works and an electric light plant is reported under consideration here; probable cost $15,000.

Tacoma, Wash.—The City Council Com. on Fire and Water has recommended that the arc circuit, which in the report of the City Engineer is estimated to cost $5,000, be installed immediately.

Arlington, Wash.—Thos. Moran is reported to have secured a franchise for a light and water system, the power to be developed from the falls of Jim Creek.

Reardan, Wash.—The Reardan Light & Power Co., it is reported, has been incorporated with a capital of $5,000, to engage in the light and power business at Reardan. Incorporators: Frank Bradley, John Fields, John Rayman and others.

Phillips, Wis.—The Phillips Light, Heat & Power Co. is reported to have petitioned for a franchise.

Mendota, Wis.—Bids will be received until Sept. 6 by the State Bd. of Control (Gustav Kustermann, Pres.) at Madison, for furnishing and installing electric wiring in the State Hospital for Insane at Mendota.

Burlington, Wis.—John T. Prasel, City Clk., writes that bids will be received Sept. 5 for the construction of a municipal lighting plant, to cost about $12,000. Engineer, A. T. Maltby, Fisher Bldg., Chicago, Ill.

Almond, Wis.—The Almond Milling Co. is stated to have petitioned for a franchise for an electric light plant.

Milwaukee, Wis.—The County Trus. are stated to have appointed the Milwaukee Engr. Co. to prepare estimates for a new electric wiring system at the county hospital. The trustees are also reported to be discussing the question of providing for a central heating, lighting and power plant and for extending the city water mains to the Wauwatosa institutions.

Westfield, Wis.—The citizens are reported to have voted in favor of establishing an electric light plant.

Pembroke, Ont.—The Pembroke Light, Heat & Power Co. is reported organized to acquire water power on Black River, for the purpose of adding to the present electric light system of the town.

Napanee, Ont.—W. A. Grange, Town Clk., writes that plans and specifications have been prepared by R. S. Kelsch, New York Life Bldg., Montreal, Que., for the proposed municipal electric light plant; probable cost, $35,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The preliminary survey and plan for the Little Rock & Hot Springs Electric R. R. is stated to have been filed.

San Francisco, Cal.—Thos. P. Woodward, City Engr., writes that plans and specifications are now being prepared for the conversion of the present Geary St. Cable R. R. into an electric road with an underground conduit from Market St. along Geary St. to Point Lobos Ave., and along Point Lobos Ave. to 5th Ave., a distance of 3.33 miles; also for the construction of a new electric underground conduit road from 5th Ave. along Point Lobos Ave. to 10th Ave., and along 10th Ave. to Fulton St., at Golden Gate Park, an additional distance of .81 mile. The cost has been estimated at $304,705, which has been appropriated and is now available. An appropriation will be made next year for the necessary cars, tools and appliances. Bids will be received for the present work in about 3 months. The stockholders of the cable railroad, whose franchise has expired, have given notice that they claim the rails and roadbed and will probably contest the city's taking possession of them for its new municipal road.

Woodland, Cal.—Sealed proopsals will be received by Chas. W. Pickard, City Clk., until 7.30 p. m., Sept. 18, for a franchise to construct an electric railway as applied for by J. Reith, Jr.

Sonoma, Cal.—The Sonoma Valley Co. is reported organized at Sonoma, and will be incorporated for the purpose of developing the resources of that section. It is proposed to construct an electric railway 6 miles in length from Sonoma to Glen Ellen, and to supply electric light and power along the route. The road will touch at Boye's Hot Springs, Agna Caliente Springs, Eldredge and El Verano.

Chicago, Ill.—Traction Expert A. B. Dupont is stated to have submitted to Mayor Dunne his report on the municipal street railway system for Chicago. It provides for a 264-mile system with through routes, the cost not to exceed $25,000,000.

East St. Louis, Ill.—Articles of incorporation are stated to have been filed by the St. Louis, Vandalia, Terre Haute & Eastern Traction Co. Capital $1,000,000. Its principal office will be in East St. Louis. The object is to construct a line from East St. Louis to Terre Haute, Ind., with branches. Directors: Peter Chase, of Decatur; Chas. W. Mills, of Chicago; Louis Bissell, of Effingham; Henry J. Wanner and William P. Baldwin, of Chicago.

Fairfield, Ia.—Carson & Barrett, Dwight Bldg., Kansas City, Mo., on Aug. 28 commenced preliminary surveys for an interurban electric railway between Fairfield, Birmingham and Keosauqua, Ia., a distance of 22 miles. Henry S. Hackbusch will have charge of the field party. E. R. Smith, an attorney, of Fairfield, states that the road will be financed by local parties, and a large part of the $500,000 to be raised has already been subscribed.

Paris, Ky.—It is stated that the Paris-Carlisle-Marysville Traction Co., of which ex-Congressman Jas. N. Kehoe, of Marysville, is Pres., has been granted a franchise to enter Paris by a route and upon streets to be designated by the City Council. The work of construction is to begin within 18 months. The Traction Co. and the County will co-operate in the building of an iron bridge over Stone Creek at the foot of Main St., 60 ft. wide, for foot passenger and vehicular traffic, with the Traction Company's lines in the center.

Augusta, Me.—The articles of association of the Norway & Western Ry. Co. are stated to have been approved by the Railroad Commissioners. The company will build an electric railway through the towns of Norway, Waterford, Stoneham and Albany, with a branch at South Waterford.

Ann Arbor, Mich.—The Toledo, Ann Arbor & Detroit Ry. Co. is reported to have been given permission to cross at grade the Ann Arbor and Wabash roads at Milan, and the Saline branch of the Ypsi-Ann, between Saline and Ypsilanti.

Jackson, Mich.—The Adrian & Jackson Traction Co. is reported to be asking the city for a franchise to construct an independent street railway from the city limits to the center of the city. The Colers, who own the Jackson & Suburban, prefer building the Adrian-Jackson line themselves to having it done by a competitor.

**Items marked thus give the names of parties awarded contracts.*

Grand Rapids, Mich.—It is stated that J. H. Roberts, of Grand Rapids, is promoting an electric line to run from Jackson to Ft. Wayne, Ind. Franchises from Garrett into Ft. Wayne have been secured, and it is reported that construction work is to begin this fall.

Florence, Mich.—See "Power Plants, Gas and Electricity."

Mankato, Minn.—H. F. Balch & Co., of Minneapolis, are stated to have secured the contract for doing the grading for the section between Albert Lea and Cream of the Duluth, St. Cloud, Glencoe & Mankato R. R.

Marshall, Mo.—E. D. Martin, of Marshall, is reported to be projecting a trolley line between Marshall and Sedalia.

Asbury Park, N. J.—It is stated that an electric railway may soon be built on Central Ave., Ocean Grove, running the entire length of the camp meeting city, and connecting with Beach Ave., Bradley Beach. The building of such a road is said to have the support of Bishop J. N. Fitzgerald, J. A. Bradley, of Asbury Park and Chas. Rogers, of Bradley Park.

Las Vegas, N. M.—The City Council is stated to have granted to W. A. Buddecke an electric railway and lighting franchise.

Syracuse, N. Y.—The proposition to extend the Liverpool line of the Syracuse Rapid Transit Co. 3 miles to Long Branch on Onondaga Lake, is reported being considered now.

Youngstown, O.—See "Power Plants, Gas and Electricity."

Toledo, O.—It is stated that plans and surveys are now being made for the extension of the Toledo & Indiana Ry., from Bryan to Ft. Wayne.

Lancaster, O.—The Lancaster Traction Co. is stated to have secured franchises for the extension of the system over several streets in this town.

Zanesville, O.—Col. Albert E. Boone is reported to be endeavoring to secure control of the water power at Stockport in the Muskingum River for his proposed road from Zanesville to Athens. He claims to have secured much of the required right of way.

Pawnee, Okla. Ter.—The Interurban Traction Co., of Oklahoma City, is reported as having surveys made for an electric railway to Norman. The contract has been let for the grading of the line from the corporated city limits of Oklahoma City to the south border line of Capitol Hill. It is the intention to extend this line on to Sulphur Springs, Ind. Ter., in the near future.

**Philadelphia, Pa.*—The contract for constructing the Market St. subway around the City Hall from 15th St. to Juniper St. is stated to have been awarded by the Rapid Transit Co. to the E. E. Smith Contr. Co., for about $3,000,000.

The engineers of the Rapid Transit Co. are reported to be preparing plans for the remaining sections of the Market St. subway, and they will be placed under contract as soon as specifications are complete.

The Rapid Transit Co. is reported considering the advisability of building an elevated road to run north and south on 52d St. If this plan is carried out, construction of the proposed elevated branches out Lancaster Ave. and Woodland Ave. may be indefinitely deferred.

Scranton, Pa.—A charter is stated to have been issued to the Scranton & West Side St. Ry. Co., with a capital of $24,000, to build 3½ miles of road in Scranton. Ezra H. Ripple, Pres., Scranton, Pa.

Pittsburg, Pa.—The Pittsburg & Cross Creek R. R. Co., capital $70,000, is reported to have secured a charter to build 7 miles of road in Washington County. N. T. Sanford, Pres., Pittsburg.

Shenango, Pa.—Private right of way is stated to have practically been secured for the Shenango St. Ry. Co. This line will be 65 miles long, and will connect New Castle, Sharon and other Shenango Valley points with Conneaut Lake, Meadville and Cambridge Springs, and will form the connecting link between Pittsburg and Erie, a distance of 150 miles. W. H. Waugh, Ch. Engr., 338 2d Ave., Pittsburg.

Brownsville, Pa.—It is stated that the Uniontown, Brownsville & West Side Ry. Co., which plans to build 16 miles of line to connect Brownsville, Bridgeport, Uniontown and other points, is in the market for cars and overhead material. J. P. Byrne, of Scottedale, Pa., Pres.

Pierre, S. D.—Articles of incorporation are stated to have been filed for the Sioux Falls Interurban Electric Ry. Co. to construct a lin from Sioux Falls to Salem, a distance of about 40 miles. Capital, $500,000. Incorporators: R. F. Brown, J. P. Bleeg, Eugene Saenger, G. W. Abbott and Geo. W. Pettigrew, all of Sioux Falls.

Nashville, Tenn.—The Nashville Interurban Ry. Co., which recently purchased the rights and franchises of the Nashville & Columbia Electric Ry. Co. and the Nashville & Gallatin Electric Ry. Co., will at once begin construction of a line from Nashville to Franklin, Tenn., a distance of 21 miles. The company is considering the use of the internal combustion engine for the operation of its cars and will be glad to correspond with builders of such equipment. Chas. S. Brown, of Nashville, is Consulting Engr. for the company.

Ft. Worth, Tex.—It is stated that the Arlington Heights St. Car Co. contemplates constructing a line in the city touching the Santa Fe Central passenger station and making a loop at the City Hall and Carnegie Library. A. V. Bauman, of Fremont, O., Pres.; W. P. Engle, of Defiance, O., Gen. Mgr.

Plano, Tex.—George W. Jarvis, Ch. Engr. of the proposed interurban electric railway to be built between Dallas and Sherman, is reported to have been looking over the route to be traversed by this line; also the most feasible route to enter the city.

Corsicana, Tex.—It is stated that J. V. Watkins, who is promoting the proposed interurban electric railway from Corsicana to Fairfield, has just returned from a trip to Palestine, where he appeared before the Board of Trade of that city with the proposition to extend the line on through Fairfield to Palestine. The proposition was favorably received, he states. It is further stated that actual construction work on the road will begin at an early date, as the franchise granting the company the use of certain streets in the city is now pending before the City Council and will be granted soon.

Tacoma, Wash.—Articles of incorporation are reported to have been filed with the Co. Aud. by the promoters of the proposed electric railway between Tacoma and Puyallup, the new company to be known as the Puyallup Valley Ry. Co. Capital $250,000. The object of the company, as stated in the articles of incorporation, is to build railways, telegraph and telephone lines, electric plants and various other things. Dir.: Fred J. Chamberlain, W. D. Cotter, W. H. Elvins and others, all of Puyallup.

Kenosha, Wis.—The Chicago & Milwaukee Electric Ry. Co. is reported to have decided to construct an electric railway to Kenosha; A. C. Frost, Pres.

Platteville, Wis.—A. O. Fox, Pres. of the Northern Electric Co.; J. P. Mallette and A. E. Oltz and Alfred Rogers, of Madison, are reported interested in the proposed electric railway from Apple River to Platteville, Lancaster and Dubuque.

RAILROADS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The stockholders of the Western Pacific R. R. Co. are reported to have met here and formally voted to increase the capital stock of the company from $50,000,000 to $75,000,000. W. J. Bartnett, of Denver, Colo., is First Vice-Pres. and Gen. Counsel of the company. Later reports state that contracts for construction have not been awarded, as previously stated, but will be in a few days.

Durango, Colo.—The Arizona & Colorado R. R. Co. (E. A. McFarland, Asst. Gen. Mgr., Tucson, Ariz.) one of the organizations that is figuring on building a railroad from Durango south, is reported to have in contemplation the construction of a line to parallel the Denver & Rio Grande road from Durango to Silverton.

Frederick, Md.—The Wabash R. R. Co. (W. S. Newhall, Ch. Engr., St. Louis, Mo.) is reported to be making surveys for a line from Frederick to Hagerstown.

**Springfield, Mo.*—The Willier Constr. Co., of Springfield, is stated to have secured the contract for constructing a branch of the Missouri Pacific R. R., from Springfield to Crane; contract price reported to amount to about $1,000,000.

Wadley, Ga.—The Stillmore Air Line Ry. Co. (G. M. Brinson, Pres., Stillmore) is reported to be considering the extension of its line north of Wadley to Warrenton and Camack.

Brazil, Ind.—The Vandalia R. R. Co. (F. T. Hatch, Ch. Engr., St. Louis, Mo.) is reported to have decided to build an extension of its line between Brazil and Saline City to Worthington, a distance of about 45 miles.

Keokuk, Ia.—The Mississippi Valley & Gulf Ry. Co. is reported incorporated with a capital of $50,000,000 under the laws of Oklahoma, with W. I. Allen, Pres.; Theo. Rockenfeller, Vice-Pres., and Elmer E. Gochanour, Secy. The right of way, most of which has been secured, leads from Keokuk as a northern terminus, south through Alexandria and southwest into Jefferson City, Mo. From Jefferson City the route will be almost due south into Little Rock, Ark., which city is now intended as the southern terminal of the main line.

Portage, N. Y.—The Genesee River R. R. Co. is reported incorporated with directors as officers of the Erie R. R. Co. (Francis Lee Stuart, Ch. Engr., New York) to construct a cut-off; to modify the grades on the Erie main line to the West. Starting from Portage, on the Buffalo division, it extends southwest 34 miles to Cuba, on the main line. It is to be built to avoid two steep grades between Hornellsville and Olean. Capital $350,000. Surveys are practically complete and contracts for construction will soon be let; probable cost of construction, $10,000,000.

Pittsburg, Pa.—The Duquesne Tunnel Co. is reported incorporated with a capital of $5,000, to build a tunnel under Pittsburg and operate a system of underground railways. The company is controlled by Geo. H. Flinn, who is a son of ex-Senator Wm. Flinn, who owns nearly all of the stock. The tunnel will be started at 7th Ave. and Grant Boule., and extend to Craig St., in the East End.

Another tunnel through Mt. Washington is reported as being planned by the Wabash R. R. (W. S. Newhall, Ch. Engr., St. Louis, Mo.) to extend from the West Side Belt Line in the borough of West Liberty to the Wabash freight terminal property on the South Side.

The Lake Erie R. R. Co. (E. A. Handy, Ch. Engr., Cleveland, O.) is reported to have decided to make extensive improvements in its warehouses and yard facilities in Pittsburg. These will cost about $2,000,000 and include a 3-story freight house and a double-deck freight yard east of Smithfield St.

Manila, P. I.—The Bureau of Insular Affairs of the War Department, at Washington, D. C., is reported to have received word from Secretary Taft at Manila that it has been decided to postpone the date of the opening of bids for concessionary contracts or grants with and by the Philippine Government in aid of the construction of railroads in the Philippine Islands from Nov. 1 until Dec. 1, 1905.

Stephenville, Tex.—Eugene Moore, Secy. of the Stephenville Commercial Club, has reported that arrangements have practically been completed for building the projected railroad from the Thurber coal mines, south via Stephenville and Hico, to Hamilton, about 60 miles. It is further stated that a company will shortly take out a charter for this work.

**Stuart, Va.*—The Vaughan Constr. Co., of Roanoke, is reported to have secured the contract for constructing 12 miles of railroad on Southern R. R., in Patrick County, for $100,000.

Puyallup, Wash.—The Puyallup Valley R. R. Co. is reported incorporated to build, operate and maintain a railway between Puyallup and Tacoma and other valley towns; capital, $250,000. Incorporators: Fred. J. Chamberlain, W. H. Elvins and W. D. Cotter.

Charleston, W. Va.—Bids will be received until Sept. 9 by N. C. Van Natta, Ch. Engr., Kanawha & West Virginia R. R., Champ Bldg., Charleston, for the graduation, masonry, trestle work and track laying of 13½ miles of proposed extension of the road.

Grafton, W. Va.—The West Virginia Midland R. R. Co. is reported incorporated with $500,000 capital, to build a line from Sutton to Webster Springs and Marlinton. Incorporators: John T. McGraw, of Grafton; C. P. Dorr, of Webster Springs; C. D. Elliott, of Parkersburg, and others.

Owen, Wis.—The Wisconsin Central R. R. Co. (C. N. Kalk, Ch. Engr., Milwaukee) is reported to be considering the construction of a new branch from Owen to Superior and Duluth.

**Portage la Prairie, Man.*—Frank W. Morser, of Montreal, Que., Vice-Pres. and Gen. Mgr. Grand Trunk R. R. Co., writes that the contract for constructing about 275 miles of main line west of Portage la Prairie (bids opened Aug. 22) has been awarded to McDonald-McMillan Co., Ltd., of Westbourne, Man.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Wilmington, Del.—Bids will be received until Sept. 12 by Harry A. Brown, Chmn. Levy Court Finance Com., for $140,000 Co. workhouse bonds.

Washington, D. C.—Bids will be received until Sept. 20 by W. S. Shallenberger, Acting Postmaster-Gen., at the office of the Purchasing Agent, for making changes in the 12 boiler furnaces in the Post Office Dept. Bldg. here, and for furnishing materials to adapt and equip the boilers for the use of anthracite coal.

The following are the bids opened on Aug. 28 by the Superv. Archt., Treas. Dept., for the steam power plant, etc., for U. S. Treasury Bldg.: Bellers & Co., Washington, $4,360, and J. E. Harley, Washington, $4,510.

Bids will be received by Capt. John Stephen Sewell, U. S. A., Contracting Officer, at U. S. Soldiers' Home, Washington, D. C., until Sept. 30, for excavating and grading, building a cement shed, for concrete work and furnishing brick, concrete material, etc., for Mess Hall, as advertised in The Engineering Record.

Geneva, Ill.—The State Bd. of Trus. of the Geneva State Home for Girls (Henry C. Wittemore, Pres., Sycamore, Ill.), it is stated, has decided to erect 3 cottages, a chapel building and a farmhouse at the Geneva Inst.

Chicago, Ill.—Bids will be received until Sept. 16 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing and setting in place the structural steel for the foundations of a building at 276 E. Madison St., known as Grower Bldg.

Barnett, Haynes & Barnett, of Chicago and St. Louis, Mo.; Holabird & Roche, of Chicago, and Shepley, Rutan & Coolidge, of Boston, Mass., received first, second and third prizes respectively for the new county building. On Aug. 28, at the meeting of the Co. Comrs., it was decided to accept the plans of Holabird & Roche (the second prize) for the building, Bedford stone to be used. Probable cost, $3,500,000.

Chicago, Ill.—Bids will be received until Sept. 7 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing materials for plumbing, sewerage, gas fitting and electric wiring the Grand Ave. Public Bath House.

Galesburg, Ill.—It is reported that bids will be received by Roy Hopcraft, City Clk., until Sept. 11 for erecting a city hall, fire dept. bldg., and patrol station.

**Hoopeston, Ill.*—H. C. Green, Chmn. Bldg. Com., writes that contract for erecting a boiler and pump house at the pumping station (bids opened Aug. 17) has been awarded to Kellogg Bros. & Vines, of Hoopeston, for $5,551.

Peru, Ind.—The question of erecting a new court house, to cost about $300,000, is reported under consideration here.

Kentland, Ind.—The Co. Comrs. have asked the Co. Council to appropriate $24,000 for the erection of a court house.

Indianapolis, Ind.—Chas. F. Humphrey, Quartermaster Gen., Washington, D. C., it is reported, is having plans prepared for a military prison to be erected near Indianapolis, at a cost of about $700,000.

South Bend, Ind.—S. S. Beman, of Chicago, Ill., it is reported, has been selected to prepare plans for a children's home, which the Christian Aid Society contemplates erecting here at a cost of $60,000.

Olathe, Kan.—It is stated that the Co. Comrs. intend erecting a new jail at a cost of $20,000.

**New Orleans, La.*—The contract to erect the Touro Infirmary (bids received July 22), it is stated, has been awarded to Geo. J. Glover, Hennen Bldg., at about $233,000.

Gretna, La.—Bids will be received until Oct. 16 by the Police Jury (M. A. Danenhauer, Secy.) for erecting a court house; plans and specifications may be had upon a deposit of $25. W. S. Hull, Archt., Jackson, Miss.

Baltimore, Md.—Bids will be received until Sept. 28 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for installing a boiler plant, ventilating and heating apparatus, etc., for the U. S. Custom House here.

Worcester, Mass.—Bids will be received until Sept. 8 by Geo. C. Halcott, Supt. Pub. Bldgs., for erecting a fire dept. building at Commercial and School Sts. Estimated cost, $26,000.

Allegan, Mich.—Plans have been prepared for a jail and sheriff's residence, which it is proposed erecting at a cost of $30,000, and, it is stated, that as soon as plans are approved the Bd. of Superv. will ask bids for the building of same.

St. Paul, Minn.—The Park Bd., it is stated, has decided to accept the plans submitted by J. Alan MacLeod for the pavilion to be erected in Como Park provided a contract can be awarded for the erection of the building. the cost not to exceed $38,000.

Kansas City, Mo.—Archt. Albert Turney, Dwight Bldg., writes that bids will be received about Oct. 1 for the erection of the new fire headquarters building to cost about $60,000.

Kendall, Mont.—It is reported that bids will be received by the Bd. Co. Comrs., at Lewistown, until Sept. 5, for erecting a jail at Kendall. F. J. Hazen, Co. Clk.

**Choteau, Mont.*—The following are reported to be the bids received Aug. 15 for erecting a court house, the bids submitted being (*a*) stone and (*b*) brick. (The contract has been awarded conditionally on the selling of the $40,000 bonds authorized by a recent election.) Bidders all of Great Falls: *a* McKenzie & Jarl, $28,311, *b* $25,377; Cooms & Duncan, *a* $32,850, *b* $28,650; Joe Wagner & Co., *a* $35,777, *b* $31,779, and Lease & Richards, Great Falls, *a* $27,795 (awarded contract).

**Items marked thus give the names of parties awarded contracts.*

Omaha, Neb.—It is stated that plans are being prepared for a brick and stone fireproof addition to be erected at the St. Joseph Hospital for which John A. Creighton is to donate the cost, which it is reported is to be between $150,000 and $200,000.

Lincoln, Neb.—The following are the bids opened on Aug. 24 by the Superv. Archt., Treas. Dept., Washington, D. C., for the ventilating and heating apparatus complete for U. S. Court House and Post Office at Lincoln: A. J. Aveliambo, Minneapolis, Minn., $14,500; J. M. McGuire, Minneapolis, Minn., $11,169; E. J. McDonough Co., Chicago, Ill., $17,992, and Iowa Mfg. Co., Oskaloosa, Ia., $15,732.

Jersey City, N. J.—The city authorities, it is stated, are contemplating the erection of a new building for the Police Headquarters. Probable cost $75,000.

New York, N. Y.—Bids will be received until Sept. 12 by J. K. Paulding, Acting Pres., Bd. Trus., Bellevue and Allied Hospitals, for furnishing and placing iron balconies on the ward wings of the new Harlem Hospital, Boro. Manhattan.

Bids will be received until Sept. 30 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for a fireproof roof over tool room of building 128, Navy Yard, New York.

New York, N. Y.—A new wing on the north side of the Metropolitan Museum of Art, 350 x 110 ft., is to be erected, the Legislature having appropriated $1,250,000 for the purpose.

Buffalo, N. Y.—The following are the bids opened on Aug. 28 by the Superv. Archt., Treas. Dept., Washington, D. C., for constructing the Marine Hospital at Buffalo, not including heating, wiring or elevators: A. B. Stannard, N. Y. City, $113,000; Fissel & Wagner, N. Y. City, $125,700; Cramp & Co., Philadelphia, Pa., $122,887; Thos. Reilly, Philadelphia, Pa., $139,330; B. M. Zodack Co., Chicago, Ill., $144,745; Morris & Somers, Buffalo, $127,000; Henry Shenk Co., Erie, Pa., $126,269; J. G. Unkefer, Chillicothe, O., $107,030, and Niedersprenn, Gibbs & Schaaf Co., Buffalo, $122,700.

Local press reports state that new plans and specifications are ready for the concrete floors, plumbing and tile and marble work in the 65th Regt. Armory, and that bids for said work will be received until Sept. 5. Geo. J. Metzger, Archt., 19 W. Huron St.

Cincinnati, O.—It is stated that the Library Bd. is having plans prepared for the Carnegie Branch Library which is to be erected on Dayton St., near Baymiller.

Massillon, O.—Plans have ben submitted by C. F. Schweinfurth, of Cleveland, for the City Hospital, which is to be erected on Akron St. The main structure is to be 2 stories high, 50 x 90 ft., and there are to be 2 wings each 1 story high. J. F. Pocock has given $50,000 for the structures.

Woodsfield, O.—The citizens have voted in favor of issuing $150,000 bonds to erect a courthouse.

Cleveland, O.—Bids will be received until Sept. 7 by Carl Lorenz, Secy. Pub. Library Bd., for furnishing materials for carpenter work and lath and plastering in public library on Crawford Rd. All other contracts have been awarded. Frank B. Meade and Abraham Garfield, Assoc. Archts., 1002 and 915 Garfield Bldg.

Williamsport, O.—Bids will be received until Sept. 9 by Brance Johnson, Clk. Deercreek Township, Williamsport, for alterations and additions to the Deercreek Township house located in Williamsport.

Oklahoma City, Okla. Ter.—Press reports state that bids will be received until Sept. 11 by the Co. Comrs. for erecting a jail to cost about $30,000.

Allentown, Pa.—It is reported that all bids opened on Aug. 23 for erecting the Homœopathic State Hospital for the Insane at Allentown have been rejected and new bids will be asked. Appropriation $500,000. Philip H. Johnson is Archt. for the institute. The following are the bids received: Doyle & Doak, $537,860; Henderson & Co., $566,527; R. E. Henningham, $583,873, and Chas. McCaul Co., $587,000.

Rochester, Pa.—J. A. Snyder, of Beaver Falls, it is stated, is preparing plans for a brick memorial home for the Passavant Home for Epileptics, which is to cost about $35,000.

**Hot Springs, S. D.*—L. G. Larson, of Plattsmouth, Neb., it is reported, has secured the contract to erect a power house at the Battle Mountain sanatorium at $16,529.

**Mitchell, S. D.*—It is reported that R. K. Hafson has secured the contract to erect a hospital at $17,000.

Crowcreek, S. D.—Bids will be received until Sept. 19 by H. D. Chamberlain, U. S. Indian Agent, for furnishing and delivering about 149,500 ft. assorted lumber; 250,000 shingles; 20,000 brick; 15,000 lbs. building paper, etc.

Savannah, Tenn.—It is stated that a court house is to be erected here at a cost of $25,000.

Midland, Tex.—A court house is to be erected here at a cost of $30,000. L. M. Murphy, Co. Judge.

Walla Walla, Wash.—It is stated that the City Clk. has been authorized to receive bids for erecting the city hall and fire station, the cost to be about $40,000.

Seattle, Wash.—It is stated that the Bd. of Pub. Wks. will receive competitive plans until Sept. 12 for a 4-story municipal building.

Olympia, Wash.—The following are reported to be the bids opened Aug. 21 for erecting an addition to and installing 66 new cells in the State Penitentiary: Minneapolis Steel & Machine Co., $15,900; Mesker Bros., St. Louis, Mo., $16,906; Western Iron Wks., San Francisco, Cal., $19,165; Pauly Jail Building Co., Seattle, $26,895; Stewart Jail Wks., Cincinnati, O., $24,146; Diebold Safe & Lock Co., Canton, O., $18,584; Van Dorn Iron Wks. Co., Cleveland, O., $28,710.

*The Bd. of Control, it is stated, has awarded the contract to install the steam heating in the Soldiers' Home to the Tacoma Plumbing & Heating Co., of Tacoma, at $3,700.

St. Boniface, Man.—See "Water."

**Calgary, Alta.*—The contract to erect an addition to the Galgary Post Office (bids received at Ottawa, Ont., Aug. 7), it is reported, has been awarded to the Alberta Bldg. Co. at about $70,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—John B. Arthur, Mgr. of the Green Bay (Wis.) Theatre, it is reported, has been engaged to superintend the construction of a $60,000 theatre at Ocean Park, near Los Angeles.

Denver, Colo.—A building permit has been granted to J. K. Mullen to erect a business building and apartment house on Stout and 17th Sts., to cost $25,000.

**Wilmington, Del.*—The Chas. McCaul Co., of Philadelphia, Pa., it is stated, has secured the contract to erect a $60,000 power house, 1-story brick and steel structure, 310x128 ft., at the plant of the Harlan & Hollingsworth Co., Wilmington.

Brooksville, Fla.—J. A. Jennings, of Brooksville, is reported to be the Pres. of a company which has been organized with a capital of $25,000 for the purpose of erecting a hotel.

Waycross, Ga.—The Elks Co., members of the Lodge of Elks, it is stated, has filed articles of incorporation for the purpose of erecting a brick building at a cost of about $25,000.

Boise, Idaho.—The plans of Ross Cartee, of Boise, it is stated, have been accepted for the Masonic Temple.

Chicago, Ill.—Hill & Woltersdorf, 70 La Salle St., are preparing plans for a 4-story business building, 67 x 134 ft., to be built for Montague Bros. at Cottage Grove Ave. and 39th St. Cost, $80,000.

Lake Forest, Ill.—The State Bank of Lake Forest contemplates the erection of a bank building in Lake Forest. Jas. Gamble Rogers, of Chicago, is now preparing plans for the building, which will be a 3-story structure, 100 x 132 ft., of pressed brick and stone, to cost $60,000.

**Hyde Park, Ill.*—The E. P. Strandberg Co., of Chicago, it is stated, has secured the contract to erect the Y. M. C. A. Bldg. in Hyde Park at $125,000. Fraos & Granger, of Chicago, are the Archts.

**Indianapolis, Ind.*—J. C. Pierson & Son, Majestic Bldg., it is stated, have secured the contract to erect the Knights of Pythias Bldg., at $61,000.

Muncie, Ind.—Delaware Lodge No. 46 of Masons, it is reported, intends erecting a home to cost about $50,000.

Indianapolis, Ind.—The officials of the Cleveland, Cincinnati, Chicago & St. Louis R. R. (A. S. Ingalls, Supt. Cleveland-Indianapolis Div., Cleveland, O.) intend erecting shops either at Brightwood or a short distance out of Indianapolis.

South McAlester, Ind. Ter.—It is reported that plans are about completed for a $100,000 Indian Consistory, which is to be erected at South McAlester by the Scottish Rite Masons. Wm. Buzbee, of South McAlester, may be able to give further information.

Sioux City, Ia.—Harry Fisher, Toy Bldg., it is stated, has been engaged to prepare plans for a 4 or 5-story warehouse for the Bekins Van & Storage Co., to be erected at 6th and Perry Sts., at a cost of about $75,000.

**Sioux City, Ia.*—It is stated that the contract to erect a 6-story building at 3d and Jennings Sts. for the Warfield-Pratt-Howell Co. has been awarded to Frank T. Houx, 306 Douglas St. Probable cost, $100,000.

*Frank T. Houx, 306 Douglas St., it is reported, has secured the contract to erect a building at 6th and Pierce Sts. for the American Realty Co., to cost $28,000.

It is reported that the directors of the First Natl. Bank are contemplating the erection of a 10-story bank building to cost $200,000.

Versailles, Ky.—The freight and passenger station of the Southern Ry. (D. W. Lum, Ch. Engr. M. of W. and Structures, Washington, D. C.), it is reported, has been destroyed by fire. It is stated that steps are being taken to replace the burned structure immediately and that probably separate buildings will be erected for the freight and passenger stations, the cost to be about $30,000.

Paducah, Ky.—It is stated that bids are wanted until Sept. 5 for erecting the Elks' Home; A. W. Grief, Secy., Elks' Bldg. Assoc.

**New Orleans, La.*—Geo. J. Glover, Hennen Bldg., it is stated, has secured the contract to erect 3 bank buildings for the Commercial Trust & Savings Bank Co., the cost to be about $25,000 each.

The Maison Blanche, Ltd., it is stated, has secured the site at Canal, Dauphin, Iberville and Burgundy Sts., and intends erecting a 13 or 14-story building.

Stone Bros., 818 Common St., and Emile Weil, 219 Carondelet St., it is stated, are the Archts. for the Athenaeum which is to be erected at St. Charles Ave. and Clio St. for the Young Men's Hebrew Assoc.

**Baltimore, Md.*—Willis & Mason, it is stated, have received the contract to erect a warehouse at 40 S. Charles St., estimated to cost $35,000.

*The Geo. A. Fuller Co., of N. Y. City, N. Y., it is reported, has applied for a permit to erect the Gaiety Theatre at Baltimore St. and Postoffice Ave. for the Columbia Amusement Co. of N. Y. City, the cost to be about $80,000.

Pittsfield, Mass.—Zenas Crane, of Dalton, it is reported, has given $25,000 with which it is proposed erecting a new building for the Boys' Club in this city. Harding & Seaver, 7 North St., are preparing plans for said building.

Grand Rapids, Mich.—Bids will be received until Sept. 11 by W. C. Grobhiser, care W. G. & F. S. Robinson, Archts., 451 Houseman Bldg., for erecting a manufacturers' building in this city.

**Minneapolis, Minn.*—John Wunder, Lumber Exchange, it is reported, has received the contract to erect the superstructure of the Minneapolis Paper Co.'s warehouse at 5th St. and 4th Ave.; cost, $60,000.

Albert Dickinson will erect a brick warehouse on Dearborn St. and 25th Ave., S. E., to cost about $16,600.

Harry W. Jones, 916 Lumber Exchange, it is stated, is preparing plans for a 7-story brick warehouse, which is to be erected at 7th St. and 3d Ave., by T. B. Walker. Cost, $200,000.

Kansas City, Mo.—Leo. N. Leslie, it is reported, is having plans prepared for a 15-story building, which is to cost about $1,000,000.

St. Louis, Mo.—The Lauren Realty Co., it is stated, has secured a lease on the site at Grand Ave. and Olive St. and will erect a 6-story fireproof building to cost about $100,000.

Omaha, Neb.—Chas. Cleves, 1st National Bank Bldg., is preparing plans for a $200,000 building to be erected on 9th and Howard Sts., to be occupied by the Byrne-Hammer Dry Goods Co. It will be 180 ft. square and 8 stories high. Owner, John A. Creighton.

Frank B. Kennard, it is stated, is having plans prepared for a 3-story brick store and office building, which is to be erected at 14th and Douglas Sts., at a cost of $25,000.

Cape May, N. J.—The New Cape May Improvement Co., it is reported, has been incorporated with a capital of about $750,000, and intends erecting a hotel and cottages. Incorporators: Peter B. Shields, of Bryn Mawr; F. G. Edwards, of Bristol, and Earl Miller, of Cape May.

Jersey City, N. J.—Eidlitz & McKenzie, of N. Y. City, it is stated, have prepared plans for a 4-story and basement building which is to be erected for the New York & New Jersey Telephone Co., on Madison and Communipaw Aves., at a cost, including equipment, of about $60,000.

Albuquerque, N. M.—The El Paso & Southwestern R. R. (H. J. Simmons, Gen. Supt., El Paso, Tex.), it is stated, intends erecting a roundhouse here to cost about $30,000.

Cloudcroft, N. M.—It is stated that "The Lodge" is to be enlarged by an addition of 100 rooms, baths and a laundry, at a cost of $20,000. Address V. R. Stiles, care El Paso & Southwestern Ry. Co., El Paso, Tex.

New York, N. Y.—It is reported that Wagenhals & Kemper intend erecting a theatre at 45th St. and Bway. Geo. Keister, 11 W. 29th St., is the archt.

Mortimer C. Merritt, 58 W. 31st St., it is reported, is the archt. for a hotel which Al. Adams contemplates erecting at 32d and 33d Sts. and 6th Ave. It is reported to be the intention to erect a building probably 49 stories high.

It is stated that plans have been filed for an 8-story fireproof hotel to be erected at 26th St. and Bway. alley by Mrs. M. G. Johnston at an estimated cost of $40,000. Thain & Thain, 4 E. 42d St., are the archts.

Brooklyn, N. Y.—Three of the principal warehouses of the Bush Terminal Co., in South Brooklyn, were destroyed by fire on Aug. 24.

Buffalo, N. Y.—S. H. Woodruff, Archt., Mutual Life Bldg., it is stated, has entered into a contract with the Cold Spring Storage Co., to erect a 6-story storage warehouse at 1532 Main St., to cost about $45,000.

Cleveland, O.—A building permit has been granted to the P. C. O'Brien Co., to erect a 5-story business building at Prospect St. and Oak Pl., to cost $50,000.

*Masters & Mullen, Rose Bldg., it is reported, have secured the contract to erect a $50,000 building on Bway for the Broadway Warehouse Co.

Portland, Ore.—B. W. Morris, of N. Y. City, it is stated, is preparing plans for a 10-story steel fireproof building which is to be erected for the Wells Fargo Co., at 6th and Oak Sts.

Magnetic Springs, O.—Wilbur T. Mills, Columbus, O., it is reported, has prepared plans for a 4-story hotel which it is proposed erecting here.

Columbus, O.—It is stated that the Midland Grocery Co. has secured a site and intends erecting a 4-story building to cost about $50,000. It is reported that plans are to be prepared for the building this winter and the contract for construction will be let in the spring.

Dayton, O.—It is reported that about Sept. 24 the Cincinnati, Hamilton & Dayton Ry. (C. A. Wilson, Ch. Engr., Cincinnati) will award the contract to erect a 3-story brick fireproof freight house here, the cost to be about $150,000.

Wilkesbarre, Pa.—John Reddington is reported to have under consideration the erection of a hotel here.

Philadelphia Pa.—A building permit has been granted to the Pennsylvania R. R. Co. to erect a 1-story brick roundhouse at 49th St. and Gray's Ferry Road at a cost of $25,000; also to Cramp & Co., 1421 Filbert St., to erect two 2-story brick stores, 85 x 112 ft., on 15th and Chestnut Sts.; cost $50,000.

Harrisburg, Pa.—The Union Trust Co., it is reported, has secured a permit to erect a bank building at a cost of about $100,000.

Uniontown, Pa.—The Uniontown Country Club, it is stated, has been organized and intends erecting a $20,000 club house.

**Pittsburg, Pa.*—Kerr & Fox, 2565 5th Ave., it is stated, have secured the contract to erect a $25,000 store and apartment house in Van Buren St. for John Farrell.

It is stated that competitive plans are being received for a 20-story building, 84 x 86 ft., which the directors of the Union Natl. Bank contemplate erecting. Probable cost, $150,000.

Pittsburg, Pa.—See "Railroads."

**Allegheny, Pa.*—The Pennsylvania R. R. Co., it is reported, has awarded the contract for the power and heating plant for the new roundhouse at Allegheny to the Cleveland Steam Fitting & Supply Co., of Cleveland, at about $30,000.

Memphis, Tenn.—The Louisville & Nashville Ry. Co. (W. H. Courtenay, Ch. Engr., Louisville, Ky.), it is stated, has secured a site at Main and Concord Sts., and intends erecting an office and freight depot.

Chickasha, Ind. Ter.—J. R. Marbett, of St. Louis, Mo., it is stated, has made a proposition to the citizens to erect a $25,000 opera house.

**Salt Lake City, Utah.*—The Salt Lake Bldg. & Mfg. Co., 40 N. 2d St. W., it is reported, has secured the contract for erecting the superstructure of the Orpheum Bldg. on State St., at $44,000.

Walla Walla, Wash.—It is reported that a stock company is being formed for the purpose of erecting a $125,000 hotel in this city.

Seattle, Wash.—Geo. Nelson and Hans Pederson, it is stated, have purchased a site at 8th Ave. and Cherry St., and intend erecting a family hotel to cost $60,000.

**Wheeling, W. Va.*—The Baltimore & Ohio R. R. Co., it is stated, has awarded the contract for the masonry work in connection with the $300,000 passenger station which is to be erected here to Hoover & Kinnear, of Columbus, O.

**Items marked thus give the names of parties awarded contracts.*

Fond du Lac, Wis.—Sidney Lovell, of Chicago, Ill., it is stated, has been engaged to prepare plans for the theatre which is to be erected here at a cost of about $30,000. M. O. Pillsbury, of Fond du Lac, is to be the Assoc. Archt., and will supervise the construction of the building.

The Masons are said to be contemplating the erection of a temple, at a cost, including furnishing, of about $25,000.

Whitefish Bay, Wis.—The Pabst Brewing Co., it is reported, intends making extensive improvements here at a cost of $100,000, including the erection of a new pavilion.

Milwaukee, Wis.—The Sokol Turner Assoc., it is stated, is contemplating the erection of a public hall on the south side to cost $35,000.

NEW YORK, N. Y.

18th St. and Ave. B, four 6-story br. and stone stores and tenemts; total c, $160,000; o, Hellman, Crump & Cohen; a, Horenburger & Straub.

161 W. 47th St., 9-story br. and stone hotel; c, $110,000; o, Horace M. Swetland; a, Jackson & Rosencrans.

1st Ave. and 38th St., 7-story br. and stone storage building; c, $80,000; o, P. Skelly; a, Geo. Butz.

66th St. and 2d Ave., five 6-story br. and stone stores and tenemts; total c, $200,000; o, Lewine & Davis; a, B. W. Levitan.

57 E. 110th St., 6-story br. and stone store and tenemt; c, $30,000; o, Saml. Sindeband; a, Horenburger & Straub.

316 E. 118th St., 6-story br. and stone store and tenemt; c, $50,000; o, Jacob Bobrow; a, Sam'l Sass.

Lenox Ave. and 116th St., 3-story br. and stone office building; c, $75,000; o, Max Rosenblum; a, L. F. J. Weiher.

148th St. and 7th Ave., 6-story br. and stone store and tenemt; c, $28,000; o and a, Henry Fulle.

Amsterdam Ave. and 167th St., two 5-story br. and stone stores and tenemt; total c, $76,000; o, Jacob Goldberg; a, E. A. Meyers.

Amsterdam Ave. and 167th St., two 5-story br. and stone stores and tenemts; total c, $105,000; o, Wein stein Bros.; a, Geo. F. Pelham.

Lenox Ave. and 136th St., two 6-story br. and stone stores and tenemts; total c, $100,000; o, David Herman; a, B. W. Levitan.

5th Ave. and 33d St., alterations to 6-story br. and stone office building; c, $25,000; o, John J. Astor; a, Harry E. Donnell.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Washington, D. C.—The members of the Adath-Israel, it is stated, intend erecting a new synagogue to cost $75,000.

Chicago, Ill.—J. T. Nicholson, 6541 Greenwood Ave., is preparing plans for 2 apartment buildings to be built at Indiana Ave. and 56th St. Each will be 3 stories high, one 63 x 90 and the other 63 x 42 ft. The total cost will be about $100,000.

A combined church and school is to be erected at 18th St. and Allport Ave., for the R. C. St. Procopius Abbey, according to plans prepared by Jos. Molitor, 160 Washington St. The building will be 4 stories high, 60 x 150 ft., and cost about $60,000.

Highland Park, Ill.—H. J. Bardwell, it is reported, intends erecting a residence here to cost $60,000.

Winona Lake, Ind.—J. M. Studebaker, of South Bend, it is reported, is having plans prepared for a residence which he proposes erecting at Winona Lake, at a cost of $25,000.

Worcester, Mass.—Edw. Topanelian, State Mutual Life Bldg., has prepared plans for a brick apartment house for E. D. Jorjorian, to cost about $80,000.

Saginaw, Mich.—C. L. Cowles, Chase Blk., is preparing plans for an apartment house for Dr. O. P. Barbs, to cost about $12,000.

Minneapolis, Minn.—J. B. Gilfillan, it is stated, has received a permit to erect a 2-story brick residence on Clifton Ave., to cost $30,000.

New York, N. Y.—It is reported that competitive plans are being received for the new St. Thomas' Church which is to replace the burned structure. Probable cost, $500,000. Dr. Ernest M. Stires, Rector.

Bay Shore, N. Y.—It is reported that plans are being prepared for a R. C. Church which is to be erected here at a cost of $40,000.

Cleveland, O.—Bernard Becker, it is stated, is preparing plans for an apartment house which is to be erected for A. E. Macomber, at Monroe St. and Collingwood Ave., at a cost of $50,000.

Dr. W. A. Wright, it is reported, is having plans prepared by Tschumy & Co. for an apartment house, to be erected at Sherman and Cherry Sts. at a cost of $25,000.

Columbus, O.—It is reported that a permit has been issued for the St. Paul's A. M. E. Church, which is to be erected at a cost of $24,000.

**Philadelphia, Pa.*—A. Whitehead, 1624 Latimer St., it is reported, has secured the contract to erect a 3-story residence and garage at Spruce and 54th Sts., for Chas. J. Swain, to cost $60,000.

Johnstown, Pa.—Miller & Mitchell, of Johnstown, it is stated, have received the contract to erect the First Christian Church at Vine and Levergood Sts., at $22,192.

Pittsburg, Pa.—J. B. Jones, it is reported, is having plans prepared for a $40,000 apartment house which he proposes erecting at Millvale and Benvenue Aves., Shadyside.

**Oakmont, Pa.*—The contract to erect the St. Thomas' Episcopal Church, it is stated, has been awarded to Milligan & Dible, of Oakmont, at about $50,000.

Brownsville, Pa.—Harry S. Estep, of Pittsburg, it is reported, is preparing plans for a residence which is to be erected here for T. H. Thompson, at a cost of $20,000.

Ft. Worth, Tex.—Bids will be received by the Bldg. Com., Box 363, for erecting an edifice for the First Congregational Church at Ft. Worth.

Walla Walla, Wash.—It is reported that the members of the Christian Church intend erecting a stone structure to cost $31,000.

Tacoma, Wash.—Fredk. Heath, Fidelity Bldg., it is reported, is preparing plans for an edifice which is to replace the St. Patrick R. C. Church, which was recently destroyed by fire. Probable cost, $25,000.

NEW YORK, N. Y.

139 E. 13th St., 5-story br. and stone tenemt; c, $22,500; o, Martin M. Heller; a, L. A. Goldstone.

602 E. 16th St., 6-story br. and stone tenemt; c, $50,000; o, Kotzen & Callan; a, Bernstein & Bernstein.

157 E. 89th St., 5-story br. and stone tenemt; c, $40,000; o, Serena Rhinelander; a, Barney & Chapman.

97th St. and Madison Ave., 6-story br. and stone tenemt; c, $75,000; o, Alex Lurie; a, Horenburger & Straub.

102d St. and 2d Ave., 6-story br. and stone tenemt; c, $50,000; o, G. Saggese; a, Moore & Landsiedel.

121st St. and Amsterdam Ave., two 5-story br. and stone tenements; total c, $84,000; o, Sam'l Patrick and Sidney Stern; a, John Hauser.

Morningside Ave. and 117th St., 6-story br. and stone tenemt; c, $225,000; o, R. M. Silverman; a, Geo. F. Pelham.

127th St. and Park Ave., 6-story br. and stone tenemt; c, $45,000; o, Isaac Michaelson; a, Horenburger & Straub.

135th St. and Bway, 6-story br. and stone tenemts; c, $110,000; o, Alex Allen Realty Co.; a, Neville & Bagge.

5th Ave. and 135th St., three 6-story br. and stone tenemts; total c, $120,000; o, Abraham Goodman; a, Horenburger & Straub.

140th St. and Bway, three 5-story br. and stone tenemts; total c, $126,000; o, The 140th St. Co.; a, Rouse & Sloan.

Edgecombe Ave. and 145th St., two 6-story br. and stone tenemts; total c, $130,000; o, J. N. Evens and Esther Cohen; a, Geo. F. Pelham.

Edgecombe Ave. and 141st St., seven 5-story br. and stone tenemts; total c, $301,000; o, F. C. Candee, Jr.; a, E. A. Meyers.

Charlotte and 170th Sts., eight 5-story br. tenemts; total c, $306,000; o, Fleischman Realty Co.; a, Geo. F. Pelham.

Wilkins Pl. and 170th St., eight 5-story br. tenemts; total c, $304,000; o, Fleischman Realty Co.; a, Geo. F. Pelham.

138th St. and Southern Boule., four 6-story br. tenements; total c, $152,000; o, Walther & Weitzer; a, Geo. F. Pelham.

139th St. and Brook Ave., 5-story br. tenemt; c, $55,000; o, Stursberg Realty Co.; a, Geo. F. Pelham.

150th St. and Beach Ave., 6-story br. tenemt; c, $75,000; o, Prospect Ave. Realty Co.; a, Moore & Landsiedel.

195th St. and Marion Ave., 4-story br. tenemt; c, $38,000; o, M. E. Flagg; a, Geo. W. Flagg.

32 Lewis St., 6-story br. and stone tenemt; c, $25,000; o, Louis Aronowitz; a, Horenburger & Straub.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Bristol, Conn.*—Roberts & Arnold, of Bristol, it is stated have secured the contract for the steam heating apparatus for the high school at $2,500.

Washington, D. C.—Bids will be received until Sept. 12 by the Bureau Supplies and Accounts, Navy Dept., for constructing a power house about 71 ft. 2 in. x 34 ft. 2 in., and with 16 ft. 6-in. clear head room, on the grounds of the U. S. Naval Medical School, Washington. H. T. B. Harris, Paymaster Gen., U. S. N.

Bids will be received until Sept. 28 by the Comr. Indian Affairs, Dept. of the Interior, Washington, for furnishing materials and constructing an agency office buildings at Pine Ridge and Cheyenne River Agencies, S. D.

West Palm Beach, Fla.—It is stated that the School Trus. intend erecting a $20,000 high school.

Chicago, Ill.—President Harper of the Univ. of Chicago, it is stated, has announced that there is $6,000,000 available with which it is proposed erecting new buildings at the Univ.

Chicago, Ill.—See "Churches and Dwellings."

Ft. Wayne, Ind.—It is reported that bids will be received until Sept. 11 by the School Trus. (E. W. Cook, Secy.) for erecting a 14-room school.

Muskogee, Ind. Ter.—See "Water."

South McAlester, Ind. Ter.—A. Thomas, Pres. School Bd., writes that it is proposed to erect 5 schools at a cost of about $100,000. Architect not yet selected.

Brazil, Ind.—The plans of Gault & Gault, of Vincennes, it is stated, have been accepted for a 10-room $25,000 school to be erected here.

Lindon, Ind.—A school is to be erected here, according to reports, to cost $50,000. Address, Bd. Educ.

Elma, Ia.—Bids will be received until Sept. 5 by the Rev. F. J. Gunn for erecting a parochial school and Sisters' house; Guido Beck, Archt., Dubuque, Ia.

Lawrence, Kan.—Bids will be received by H. B. Peairs, Supt., Haskell Inst., for furnishing and delivering at said building 118,000 brick, 108,000 ft. lumber, 6,635 bbls. castings, 110 bbls. cement, radiators, electric supplies, etc.

Donaldsonville, La.—It is stated that $56,000 bonds have been sold, $31,000 to be used to extend the water works, and $25,000 toward the erection of a $50,000 school.

**Watertown, Mass.*—It is reported that the following are the bids received for erecting the grammar school: David T. Burns, $56,700; W. Crane, $54,994; Dillion Bros., $54,419; W. H. Wilson, $52,610; W. R. Cummings & Co., $59,987; Whiton & Haynes Co., $50,180; W. H. Cliffe, $50,000; H. McGahey, $49,900; P. G. Rice & Co., $48,827; John N. Bruty, $47,000; A. B. Murdough, Russell Ave., $44,837 (awarded contract).

Ann Arbor, Mich.—School bonds amounting to $200,000 have been sold.

Holland, Mich.—It is stated that $25,000 has been given to Hope College to erect a women's dormitory.

Saginaw West Side, Mich.—Bids will be received until Sept. 7 by the Bd. Educ. of the Union School Dist. (Arthur D. Bate, Clk.) for erecting, heating, plumbing and electric wiring an 8-room brick addition to the Stone School; Roy J. Merriam, Archt., Bearinger Bldg., Saginaw, E. S.

Winona, Minn.—The Bd. of Trus. of Gale College, it is stated, is about to ask bids for erecting a dormitory at the college to cost $55,000.

**Duluth, Minn.*—L. D. Campbell, of Duluth, it is reported, has been awarded the contract to erect the new dormitory for the Duluth normal school (bids received Aug. 19). Appropriation, $40,000.

**Afton, Mo.*—The contract to erect a 2-story brick school, it is stated, has been awarded to L. C. Davis & Son, of Old Orchard, Mo., at $12,000.

Jocko, Mont.—Bids will be received until Sept. 20 by the Comr. Indian Affairs, Washington, D. C., for furnishing materials and constructing 2 day school buildings and 2 employees' quarters at the Flathead Reservation. Saml. Bellew, U. S. Indian Agent, Jocko.

Jersey City, N. J.—The following are reported to be the bids received Aug. 24 for erecting an addition to School No. 27, on Graham St.:

Entire work, E. T. Phillips, $100,924.

Mason work, M. T. Connolly Constr. Co., $36,294; Gavin & Doris, $36,000; Chas. Keuderly, $35,397.

Carpenter work, A. J. Dittmar & Sons, $32,400; Barron-Donaldson, $29,675; Thos. Mahoney, $26,397; Lane & Russell, $24,200.

Heating and ventilating, John T. McLaughlin, $17,844; Heatherton Bros., $11,956; Frank P. Schroeder, $11,850.

Plumbing, Fergus T. Kelaher, $6,990; Worden & Crawford, $6,896; Heatherton Bros., $6,656.

Santa Fe, N. M.—Bids will be received by C. J. Crandall, Supt. U. S. Indian School, Santa Fe., for furnishing and delivering 43,500 brick, 31,000 ft. lumber, 2,200 bbls. kalsomine, 5 bbls. cement, etc., at said building.

New York, N. Y.—Bids will be received until Sept. 11 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for erecting 2 iron stairs on the outside of school No. 17, installing ventilating and heating apparatus in school No. 38, both in Manhattan Boro., for general construction of additions to and alterations in school No. 28, Boro. Bronx, and for constructing boiler house addition and chimney at school No. 20, Boro. Queens.

Brooklyn, N. Y.—The following are the bids opened on Aug. 28 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for work on schools in Brooklyn Boro.:

*General construction of a 5-class room addition, etc., to Public School 41 (annex No. 2): Geo. F. Driscoll, $29,883; Francis Sullivan, $30,863; Jos. Ohlhausen, 257 Stockholm St., $26,444 (awarded contract); Wm. Horne Co., $30,823; Geo. Stanton, $28,713, and P. S. O'Brien, $26,743.

*For ventilating and heating apparatus in addition to and alterations in School 89: Dowdeswell Bros., $14,525; Rossman & Bracken Co., $15,000, and E. Rutzler Co., 178 Centre St., N. Y. City, $14,018 (awarded contract).

*Sanitary work and gas fitting of School 149: Wm. C. Ormond, $24,800; Matthew J. Crowley, $29,525; Rossman & Bracken Co., 132 E. 42d St., N. Y. City, $24,800 (awarded contract); Frank J. Fee, $26,593; Jas Fay's Son, $27,400.

Long Island City, L. I., N. Y.—Bids will be received until Sept. 11 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the sanitary work and gas fittings in addition to School No. 1.

Hempstead, L. I., N. Y.—It is reported that plans are being prepared for a school to be erected at a cost of $55,000. Chas. H. Ludlum, Pres. School Trus.

**Girard, O.*—The Heller Bros. Co., of Youngstown, it is stated, has secured the contract to erect the 8-room brick school (bids received Aug. 4) at $37,524.

Miamisburg, O.—It is reported that the Bd. of Educ. has voted favorably on a $50,000 bond issue to erect a school and purchase a site for same on E. Central Ave.

Cleveland, O.—The following are reported to be the lowest bids received Aug. 14 by the Bd. Educ. for erecting a 12-room addition to the Marion School: Mason, D. C. Griese & Walker Co., $13,675; carpenter work, Henry J. Rochford, $3,949; iron and steel, T. H. Brooks & Co., $8,937; heating and ventilating, Van Sickle & Warren Co., $8,183; plumbing, Dewstoe, Brainard & Co., $3,347, and electrical work, The Erner Electric Co., $422.

Wellston, O.—Bids will be received until Sept. 11 by the Bd. of Educ. (L. B. Denning, Clk.) for erecting an 8-room school, work to include brick, concrete, cut stone, galvanized iron, tin and slate roof work, steel and iron work, plumbing, ventilating and heating, sanitary work, etc. Bids on material and labor to be submitted separately.

Maynard, O.—Bids will be received until Sept. 11 by the Bd. Educ. of Colerain Township (J. W. Kennedy, Clk.) at Pleasant Grove for erecting a school at Maynard.

Akron, O.—The following are reported to be the bids received Aug. 21 for erecting complete the school on North Hill: Jacob M. Gayer, $43,492; O. L. McMillen, $44,704; Geo. W. Carmichael & Co., $46,000; John Crisp & Son, $47,462, and Wm. Gayer, $48,788.

Oklahoma City, Okla. Ter.—Dr. N. J. Weeks, Rush Medical College, Chicago, Ill., it is reported, is one of the directors of the company which has been organized recently for the purpose of erecting the Oklahoma State College here. Capital, $75,000.

**McKeesport, Pa.*—Brieck Bros., it is reported, have secured the contract to erect three 12-room schools in the 11th Ward at $115,282.

Nashville, Tenn.—The City Council has passed an ordinance appropriating $50,000 for the erection of a high school.

Nashville, Tenn.—The Bd. of Educ. has secured a permit to erect a school in the 14th Ward at a cost of $14,000.

Tioga, Tex.—Bids will be received until Sept. 5 by Matt Bradley, Secy. School Bd., for erecting an 8-room, 2-story and basement brick school.

Lancaster, Tex.—The Attorney General has approved the $15,000 Independent School Dist. bonds.

**Central City, W. Va.*—The contract to erect the high school, it is reported, has been awarded to A. L. Shockey at about $15,000.

**West Allis, Wis.*—The following are the contracts awarded for erecting a brick school on National Ave., in Dist. No. 5, bids for which were received on Aug. 22:

**Items marked thus give the names of parties awarded contracts.*

Mason work, Kroening & Son, $9,998; cut stone, Edson & Tingley, $1,265; plastering, August Barteldt, $1,938; iron work, American Bridge Co., $1,432; carpenter work, C. S. Reed, $9,313; galvanized iron and slating, Smith-Blodgett Co., $2,060; gas pipe, Smith-Blodgett Co., $130, and heating apparatus, the American Fdy. & Furnace Co., $2,895.

Galesville, Wis.—It is stated that bids will be received until Sept. 12 by O. R. Skaar, La Crosse, for erecting a dormitory at Gale College.

Appleton, Wis.—It is reported that bids are wanted until Sept. 7 (readvertisement) for erecting a Carnegie Library for the Lawrence Univ.; probable cost, $50,000. Van Ryn & Degelleke, Archts., Milwaukee; Saml. Platz, Pres.

Milwaukee, Wis.—Plans are being prepared, it is stated, for a Normal School.

Guelph, Ont.—Bids will be received until Sept. 5 by the Dept. Pub. Wks., of Ontario, at Toronto (J. O. Reaume, Minister) for erecting a building for farm mechanics and 2 cottages at the Agricultural College, Guelph.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The question of garbage disposal is reported under consideration here.

Galesburg, Ill.—The question of constructing a garbage crematory is reported under consideration by City Council.

**Evansville, Ind.*—Roetzel & Eichel is stated to have secured the contract for sweeping the streets for 15½ months at 14.9 cts. per 10,000 sq. ft. The contract dates from Sept. 15 to Jan. 1, 1907. It calls for 266,200 sq. ft. daily, 2,002,420 tri-weekly, and 3,993,813 semi-weekly.

Indianapolis, Ind.—The following are reported to be bids opened on Aug. 21 by the Bd. of Works:

For the collection, removal and disposal of ashes and sweepings for 10 yrs.: Miller & Robison, $23,500; Kennington Bros., $39,500; Claudis C. Jones, $30,000; Marion County Constr. Co., $31,500; Indianapolis Sanitary Co., $29,500, and S. K. Ruick, $34,500, stipulating a yearly increase of $1,000, which would bring the contract price at the end of the 10-yr. period to $44,500.

For the removal, delivery and disposal of garbage and dead animals: Marion County Constr. Co., $53,820; Indianapolis Reduction Co., $57,975, and Frank T. Edenharter, $70,980.

New York, N. Y.—Bids will be received until Nov. 6 by John McG. Woodbury, Comr. Street Cleaning, for the disposal of garbage in the Boro. of Manhattan, for a period of 5 years beginning Aug. 1, 1906.

Philadelphia, Pa.—The following are the lowest bids opened on Aug. 23 by A. L. Acker, Dir. Pub. Wks., for street cleaning and the removal of ashes for 1906, according to districts: David Peoples, for Districts Nos. 1, 2, 3 and 11, $86,000, $52,000, $96,000 and $54,000 respectively; E. H. Vare, Dist. 4, $88,900; Jas. Curran, for Dists. 5, 6 and 7, $105,507, $55,907 and $82,186 respectively; David McMahon, for Dists. 8 and 9, $144,900 and $87,700 respectively, and Miles J. McGehan, Dist. 10, $64,385.

Houston, Tex.—Mayor Rice is stated to have decided to ask for bids for the removal and disposal of the city's garbage; also for bids from parties who will furnish city with teams, wagons and drivers with which to do this work.

Sherman, Tex.—Bids will be received by the City Engineer on Sept. 18 for a street sweeping machine, as advertised in The Engineering Record.

NEW INDUSTRIAL PLANTS.

See also Business Building.

Sears, Roebuck & Co., Chicago, Ill., have secured site for the erection of a $500,000 stove works at Mt. Vernon, O., according to local newspaper reports.

The National Enameling & Stamping Co. will begin at once the erection of a new $150,000 plant on property recently acquired at Newtown, L. I., according to local newspaper reports.

Forest City Paint & Varnish Co., Cleveland, O., is reported to have purchased site for a $75,000 plant to be erected shortly.

The American Agricultural Chemical Co. has purchased site on Newtown Creek, Brooklyn, L. I., for the erection of a $150,000 plant, according to local newspaper reports.

Pacific Coast Lime Co., Seattle, Wash., will shortly begin the erection of a new lime kiln to cost $15,000, according to local newspaper reports.

The American Box File Co., Atlanta, Ga., is in the market for paper box machinery.

The Bagley & Sewall Co., Watertown, N. Y., is erecting an addition to its present plant, consisting of a 2-story brick and steel building measuring 140x30 ft. New electrically operated machinery will be installed.

D. T. Sutherland Machine Works & Foundry, Bainbridge, Ga., are building new machine shop, pattern shop and engine room, all of brick and iron construction and measuring respectively 52x104 ft., 25x40 ft. and 25x40 ft. A new foundry will be constructed later.

Mr. Columbus Bierce, Meridian, Miss., is erecting a new cotton compress, and is in the market for a quantity of pitch, roofing paper and a hydraulic pump or ram to operate without steam.

New Castle (Pa.) Forge & Bolt Co. will begin at once the rebuilding of its plant, recently destroyed by fire. The new building will be of steel construction and measure 100x400 ft. A power plant of about 1,000 hp. will be installed.

Hill, Williamson & Co., Montezuma, Ga., are erecting a new planing mill and are in the market for an 80-hp. engine and general planing mill equipment.

Alma Mfg. Co., Baltimore, Md., is about to begin the erection of an addition to its plant, consisting of 2½-story and basement building measuring 64x203 ft., and a power house geenrating 300 kw.

U. S. Blowpipe & Hydraulic Works, Seattle, Wash., will begin at once the erection of a building measuring 60x160 ft., and are in the market for the following tools and machinery: 1 rotary splitting shear for elbow work, ¼ gauge and heavier; 1 squaring shear 50 inches between housing about ¼ gauge capacity; 1 splitting shear to split sheets of any length and width about ½-inch capacity; 1 set slip end rolls 60 or 72 inches between housing; 1 set slip end rolls 10 feet between housing; 1 drill press, 1¼-inch hole; 1 small band saw about 36-inch wheels; 1 portable scale about 2,000 lbs. capacity; 1 8-hp. upright tube or pipe boiler; 1 dipping tank, half round, about 4 ft. wide, 4 ft. deep and 30 ft. long; 1 30-inch sheet-iron folder, capacity about 20 gauge; 1 turning machine, capacity about 16 gauge; 1 tinners brake, capacity about 14 gauge, 10 ft. long; 1 beading and crimping machine, capacity about 16 gauge.

The Pressed Steel Pole Co., Pittsburg, Pa., will shortly begin the erection of a new plant. The new building will measure 50x200 ft. and will be electrically operated, about 50 hp. being required.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The Comrs. of Levee Dist. No. 1 are stated to have decided to issue $30,000 bonds to repair the levee and raise it 3 ft.

**San Francisco, Cal.*—The bid of Palmer & McBryde, of San Francisco, opened on Aug. 18 by Capt. Wm. W. Harts, Corps Engrs., U. S. A., Secy. California Debris Comn., for building inlet wall at Daguerre Point Cut, Yuba River, is as follows, and has been recommended for acceptance: Excav. foundations, 2,200 cu. yds. earth, $1; excav. foundations, 200 cu. yds. rock, $1.50; placing 140 cu. yds. back fill., $1; placing 300 cu. yds. embankment, 75 cts.; furnishing and placing 2,340 cu. yds. concrete, $5; furnishing and placing 30,100 lbs. plain steel bars, 6 cts.; furnishing and placing 8,300 lbs. twisted or corrugated steel bars, 7 cts.; excav. 32,000 cu. yds. earth and 1,000 cu. yds. rock from entrance to cut, 45 cts.; total, $31,802.

**New London, Conn.*—The following are the bids opened on Aug. 26 by Lieut. C. F. Powell, Corps Engrs., U. S. A., for dredging in West River, from New Haven Harbor, Conn., 270,000 cu. yds. (price given per cu. yd.): Morris & Cummings Dredging Co., New York, N. Y., 18½ cts.; Geo. W. Catt, New York, N. Y., 13.1 cts. (recommended for acceptance); John P. Randerson, Albany, N. Y., 23 cts.; J. S. Packard Dredging Co., Providence, R. I., 17.85 cts.; John & Jos. McSpirit, Jersey City, N. J., 13.9 cts.; Seely-Taylor Co., New York, N. Y., 16 cts.

Washington, D. C.—Bids will be received until Sept. 26 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Naval Station, Guantanamo Bay, Cuba, a quantity of telephones and telephone cables. H. T. B. Harris, Paymaster-Gen., U. S. N.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Key West, Fla.—The following are the bids opened on Aug. 26 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for filling and grading Naval Sta. at Key West, 54,000 cu. yds. (price given per cu. yd.): Roderick G. Ross, 204 East Bay, Jacksonville, 49 cts., and Southern Dredging Co., Mobile, Ala., 95 cts.

**Jacksonville, Fla.*—H. B. Woodward, Chief Clk., U. S. Engr. Office, Jacksonville, writes that the contract for dredging and removal of rock in Withlacoochee River Entrance, Fla. (bids opened July 12) has been awarded to Alex. G. Bigelow, of Rockwell, Fla., for $14,000.

Chicago, Ill.—The following are the bids opened on Aug. 19 by J. M. Patterson, Comr. of Pub. Wks., for boring in Lake Michigan on line extending from 68th St. crib to foot of 73d St.: John Green, $8 per lin. ft., and Great Lakes Dredge & Dock Co., $10.

Oliver C. Brown is reported to be Secy. and Mgr. of a company which has purchased property on the west side of Desplaines Ave. and Harrison St., as a site for a $2,000,000 amusement park.

Bids will be received until Sept. 11 by Chas. J. Whalen, M.D., Comr. Health, for furnishing materials and building a brick or concrete wall of 2,400 lin. ft. around the grounds of the Isolation Hospital, 35th St. and Lawndale Ave.

Bids will be received until Oct. 25 by the Bd. Trus. Sanitary Dist. (S. D. Griffin, Clk.) for constructing a concrete dock.

Boone, Ia.—It is stated that bids will be received until Sept. 15 by A. Patterson, Co. Aud., for constructing county drain No. 13, requiring 1,800 ft. 13-in., 4,400 ft. 12-in., 900 ft. 8-in. and 1,000 ft. 6-in. tile.

Council Bluffs, Ia.—Bids will be received until Sept. 19 for work on Sections 1, 2, 3 and 4 of Drainage Plans of Dist. 1 of Harrison and Pottawattamie Counties, to consist of about 28 miles of open channel, of 16 to 40 ft. bottom width, and ranging from 5 to 14 ft. deep, as advertised in The Engineering Record.

Des Moines, Ia.—Bids will be received until Sept. 23 by the Joint Bd. Superv., Polk and Storey Counties, for constructing a ditch containing about 19,214 lin. ft. and requiring the removal of about 47,000 cu. yds. earth. Lew Burnett, Co. Aud., Des Moines.

Chanute, Kan.—J. F. Mundy, of Chanute, and the Mellons of the Mellon National Bank, of Pittsburg, Pa., are reported interested in the construction of a pipe line from the Kansas and Ind. Ter. oil fields to the Gulf; there will be about 680 miles of 8-in. main, 200 miles of 4-in. and 600 miles of 2 and 3-in.; cost of pipe lines with the necessary stations will be about $4,500,000.

Bossier, La.—Later official reports state that bids will be received until Oct. 5 (not Nov. 5 as previously stated) by the Bossier Levee Comrs., for $50,000 bonds. For further particulars apply to T. N. Braden, Jr., Secy., Curtis, La.

New Orleans, La.—The following are the bids opened on Aug. 10 by Capt. J. F. McIndoe, Corps Engrs, U. S. A., for constructing about 870,000 new levee at Bourgere in Lower Tensas Levee Dist. (price given per cu. yd.): Ogden Bros., Baton Rouge, La., for 135,000 cu. yds., 22.97 cts.; H. F. Hodge, Natchez, Miss., for 136,800 cu. yds., 27 cts.; Helgason Bros., Vicksburg, Miss., for 244,300 cu. yds., 33⅓ cts., and 120,000 cu. yds., 34⅓ cts., and I. R. Bobbitt, Harwood, Ark., for 119,500 cu. yds., 27.5 cts., and 115,500 cu. yds., 19 cts.

Hearen & Ryan, of Baton Rouge, bid on Aug. 11 for about 423,000 cu. yds. levee work in Pontchartrain Levee Dist., 16.5 cts. per cu. yd.

Bids will be received until Sept. 7 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., for constructing about 118,700 cu. yds. levee work in the Barataria Dist.

Baltimore, Md.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 26, for the passenger and freight elevators for the U. S. Custom House at Baltimore, as advertised in The Engineering Record.

Bids will be received until Sept. 20 by the Bd. of Awards (E. Clay Timanus, Pres.) to erect the Fulton Ave. entrance to Druid Hill Park. Wyatt & Nolting, Archts., 2 E. Lexington St.

**Boston, Mass.*—Fred. N. Wales, Clk. Bd. Harbor and Land Comrs., writes that the contract for dredging in Nantucket Harbor (bids opened Aug. 24) has been awarded to Morris & Cummings Dredging Co., 17 State St., New York, N. Y., at 28 cts. per cu. yd.; net amount of material estimated to be removed is 10,400 cu. yds.

Bids will be received until Sept. 30 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing an extension of the track for locomotive crane, Navy Yard, Boston.

The following are the lowest bids opened on Aug. 24 by the Harbor and Land Comrs., at Boston, Mass.: For constructing breakwater in Vineyard Haven Harbor, E. S. Belden & Sons, Hartford, Conn., $1.47 per lin. ft., and for building extension to sea wall and jetties, at Stony Beach, Hull, Wm. L. Miller, 19 Milk St., at $8.23 and $3.52 per lin. ft.

Detroit, Mich.—Press reports state that the Canadian Tunnel Co. and the Michigan Tunnel Co., the two companies chartered to build the tunnel under the Detroit River, met recently at Windsor, Ont., and combined under the name of the Detroit River Tunnel Co. The new company is capitalized at $3,000,000. Actual work on the tunnel will probably be started in October. H. S. Kinnear, Ch. Engr.

Ft. Snelling, Minn.—Bids will be received until Sept. 8 by R. M. Schofield, Constr. Q. M., St. Paul, for constructing down spout, floor drains and drainage ditches at Ft. Snelling.

Pine Creek, Minn.—Bids will be received until Oct. 2 by the Bd. Co. Comrs. for $5,950 bonds for draining ditch No. 2. D. Greeley, Co. Aud.

Billings, Mont.—Bids will be received at the office of the engineer, U. S. Reclamation Service, Billings, until Sept. 26 for furnishing 25,000 bbls. Portland cement f. o. b. cars at works of bidder, as advertised in The Engineering Record.

Newark, N. J.—The lowest bid opened on Aug. 22 by the Essex County Park Comn., for concrete steps to replace the wooden ones in Branch Brook, West Orange, West Side and Watsessing Parks, was submitted by Robt. W. Smith, for $6,091. The only bid received for the stone steps was submitted by the Newark Bluestone Co. for $18,361.

New York, N. Y.—Bids will be received until Sept. 14 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging in Port Chester and Mamaroneck Harbors, East Chester Creek and Great South Bay, N. Y.

Binghamton, N. Y.—The City Council is reported to be considering the question of building a municipal subway, in which all the telephone and telegraph wires will be placed.

Findlay, O.—It is stated that bids will be received until Sept. 5 by the Bd. Pub. Service (J. C. Edie, Clk.) for furnishing material and constructing a sanitary dam across Blanchard River.

**Wauseon, O.*—John F. Hettinger, County Surveyor, writes that the contract for constructing the ditch, to be known as Bean Creek Improv., to comprise about 286,974 cu. yds. dredge work and 28,504 cu. yds. team work, has been awarded to Gilmore's Sons, of Toledo, for $36,500.

Panama.—Bids will be received until Sept. 22 by D. W. Ross, Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing hand rolling mill, vises, oil stones, milling tools, files, tweezers, buffs, cells for battery, steel brake shoes, etc., at Panama.

Pittsburg, Pa.—See "Railroads."

Olongapo, P. I.—The following are the bids opened on Aug. 26 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a coal storage and coal handling plant at the naval station, Olongapo: Snare & Triest Co., New York, N. Y.. $500,000, and J. G. White & Co., Inc., New York, N. Y., $499,500.

Newport, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., until Sept. 14 for constructing extension to jetty and revetment at entrance to Point Judith Pond, R. I., as advertised in The Engineering Record.

The following are the bids opened on Aug. 30 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., for construction to shore arm of breakwater at Point Judith, R. I.: (*a*) Seaward extension, shore arm breakwater, 100,000 tons, price per net ton; (*b*) shoreward extension and revetment, 2,500 tons, per net ton; (*c*) total cost: Rockport Granite Co., Rockport, Mass., *a* $1.79; *b* $2,79; *c* $185,975. E. S. Belden & Sons, Hartford, Conn., *a* $2.23; *b* $1.75; *c* $234,857. John F. Donovan, New York, N. Y., *a* and *b* $1.80, *c* $184,500.

Pawtucket, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, until Sept. 20, for rock excavation in Pawtucket River, as advertised in The Engineering Record.

Seattle, Wash.—The following are the bids opened on Aug. 19 by Maj. John Millis, Corps Engrs., U. S. A., for dredging Grays Harbor and Chehalis River, 69,000 cu. yds. (price given per cu. yd.): North American Dredging Co., San Francisco, Cal., 35.2 cts.; International Contract Co., Seattle, 39 cts., and San Francisco Bridge Co., San Francisco, Cal., 33⅓ cts.

Milwaukee, Wis.—City Engr. Chas. J. Poetsch is stated to have completed plans for widening Kinnickinnic River to a width of 200 ft., from the Chicago Road to Clinton St. Bridge; total cost of work, including widening, dredging, rebuilding bridges, etc., is $400,000. The U. S. Government will do the necessary dredging in channel and turning basins.

**Items marked thus give the names of parties awarded contracts.*

PROPOSALS OPEN

For Proposals see pages 72, 73, 76, 77 and 79,

WATER WORKS.

Bids Close.		See Eng. Record.
Sep. 5.	Dam, etc., Cody, Wyo Adv. Jul. 15 to Aug. 5.	Jul. 15
Sep. 5.	Standpipe, Stromsburg, Neb.	Aug. 12
Sep. 5.	Irrig. Canal, Turlock, Cal	Aug. 19
Sep. 5.	Conduit, etc., Richmond, Va	Aug. 19
Sep. 5.	Water Wks., Princeton, Ky Adv. Aug. 26.	Aug. 26
Sep. 5.	Dam, Columbia, Pa. Adv. Aug. 26.	Aug. 26
Sep. 5.	Reservoir, Marion, Ind	Sep. 2
Sep. 5.	Exten. to system, Yarmouth, Me	Sep. 2
Sep. 6.	Tunnel, etc., Cody, Wyo Adv. Jul. 15 to Aug. 5.	Jul. 15
Sep. 6.	Collectors, etc., Philadelphia, Pa Adv. Aug. 12 to Sep. 2.	Aug. 19
Sep. 6.	Tunnel, etc., Chicago, Ill	Aug. 26
Sep. 6.	Reservoir, Ft. McPherson, Ga Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 6.	Water wks. improv., Dover, Pa Adv. Aug. 26.	Aug. 26
Sep. 6.	Mains, New York, N. Y	Aug. 26
Sep. 6.	Engines, mains, etc., Brooklyn, N. Y.	Aug. 26
Sep. 7.	System at school, Toledo, O	Aug. 12
Sep. 7.	Mains, Norfolk, Neb	Aug. 19
Sep. 11.	Well, Ft. Hancock, N. J.	Aug. 19
Sep. 11.	Conduit, Toledo, O.	Aug. 26
Sep. 12.	Water Wks., Franklin, Tenn Adv. Sept. 2.	Sep. 2
Sep. 12.	Pump, engines, Buffalo, N. Y	Sep. 2
Sep. 13.	System, Southern Pines, N. C.	Aug. 19
Sep. 13.	Settling basins, St. Louis, Mo	Sep. 2
Sep. 14.	Pumping machinery, Columbus, O Adv. Aug. 5 to Sep. 2.	Aug. 5
Sep. 14.	System, Shawnee, Okla. Ter	Aug. 26
Sep. 15.	Tank, etc., Ft. Myer, Va Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 15.	C.-I. pipe, etc., Cincinnati, O	Sep. 2
Sep. 18.	C. I. Pipe, Victoria, B. C	Aug. 19
Sep. 19.	Pumps, etc., Toronto, Ont Adv. Aug. 5 to 19.	Aug. 5
Sep. 19.	Pump, engine, Burlington, N. J Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 21.	Pump, sta., Galveston, Tex Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 25.	Water wks., Glendive, Mont	Aug. 26
Sep. 26.	Tunnel, Montrose, Colo Adv. Aug. 12 to Sep. 2.	Aug. 12
Sep. 28.	Tank, Vancouver Barracks, Wash Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 29.	Filters, etc., Cincinnati, O Adv. Sep. 2.	Sep. 2
Sep. 29.	Boiler, wells, etc., Ft. Screven, Ga Adv. Sep. 2.	Sep. 2
Sep. 30.	Pipe laying, Perth Amboy, N. J	Aug. 26
Sep. —	Water Wks., E. Grand Forks, Minn	Aug. 19
Sep. —	Water works, Jackson, Mo	Aug. 19
Sep. —	Reservoir, McLeansboro, Ill	Aug. 26
Oct. 12.	Sale of standpipe, Attleboro, Mass Adv. Jul. 29 to Aug. 5.	Jul. 29
Oct. 17.	Embankment, Roswell, N. M Adv. Aug. 26 to Sep. 2.	Aug. 26
Oct. 26.	Dams, canals, etc., Belle Fourche, S. D. Adv. Sep. 2.	Sep. 2
———	Water wks. or franchise, Muncie, Ind. Adv. Jul. 29.	Jul. 29

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 5.	Harrison, N. J.	Aug. 12
Sep. 5.	Centerville, Ia.	Aug. 26
Sep. 5.	Jersey City, N. J.	Sep. 2
Sep. 5.	Alliance, O.	Sep. 2
Sep. 6.	New Hampton, Ia.	Aug. 26
Sep. 6.	Owosso, Mich. Adv. Aug. 26.	Aug. 26
Sep. 6.	Chicago, Ill.	Sep. 2
Sep. 6.	Zanesville, O.	Sep. 2
Sep. 6.	Appleton, Wis.	Sep. 2
Sep. 6.	Indianapolis, Ind.	Sep. 2
Sep. 7.	Washington, D. C. Adv. Aug. 26.	Aug. 26
Sep. 7.	Delaware, O.	Aug. 26
Sep. 7.	Ballston Spa, N. Y	Sep. 2
Sep. 8.	Cincinnati, O.	Sep. 2
Sep. 9.	Boise, Idaho	Aug. 26
Sep. 9.	Rhinelander, Wis.	Sep. 2
Sep. 11.	Willoughby, O.	Aug. 19
Sep. 11.	Washington, D. C. Adv. Sep. 2	Sep. 2
Sep. 11.	New Ulm, Minn. Adv. Sep. 2.	Sep. 2
Sep. 12.	Nevada, Mo.	Aug. 26
Sep. 13.	Lexington, Ky. Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 13.	Brooklyn, N. Y.	Aug. 26
Sep. 13.	Chicago, Ill.	Sep. 2
Sep. 13.	Ft. McIntosh, Tex.	Sep. 2
Sep. 13.	Sewers, St. Louis, Mo.	Sep. 2
Sep. 14.	Shawnee, Okla. Ter.	Aug. 26
Sep. 14.	Des Moines, Ia.	Sep. 2
Sep. 14.	Reading, Pa.	Sep. 2
Sep. 15.	Ft. Worth, Tex	Aug. 26
Sep. 15.	Rushford, Minn.	Sep. 2
Sep. 18.	Indianapolis, Ind.	Sep. 2
Sep. 19.	Southern Pines, N. C.	Aug. 19
Sep. 20.	Salem, O.	Sep. 2
Sep. 21.	Cincinnati, O.	Sep. 2
Sep. 22.	Cincinnati, O.	Sep. 2
Sep. 25.	Glendive, Mont.	Aug. 26
Sep. 27.	Haddonfield, N. J. Adv. Sep. 2.	Sep. 2
———	Seattle, Wash.	Sep. 2

BRIDGES.

Sep. 5.	Columbus, O.	Aug. 12
Sep. 5.	Crawfordsville, Ind.	Sep. 2
Sep. 6.	Colusa, Cal.	Aug. 26
Sep. 6.	Leavenworth, Kan.	Sep. 2
Sep. 6.	Monticello, Ind.	Sep. 2
Sep. 6.	New Brunswick, N. J.	Sep. 2
Sep. 7.	Norwalk, O.	Aug. 26
Sep. 8.	Virginia City, Mont.	Jul. 26
Sep. 8.	Albany, Ore.	Aug. 26
Sep. 8.	New Albany, Ind.	Sep. 2
Sep. 8.	Weaverville, Cal.	Sep. 2
Sep. 11.	Chillicothe, O.	Aug. 26
Sep. 11.	Circleville, O.	Sep. 2
Sep. 11.	Moscow, Idaho	Sep. 2
Sep. 15.	Delaware, O.	Sep. 2
Sep. 15.	New Philadelphia, O.	Sep. 2
Sep 16.	Washington, D. C. Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 16.	New Philadelphia, O.	Sep. 2
Sep. 19.	Hartford, Conn. Adv. Sep. 2.	Sep. 2
Sep. 19.	Upper Sandusky, O.	Sep. 2
Sep. 25.	Washington, D. C. Adv. Sep. 2.	Sep. 2
Sep. 30.	San Juan, Porto Rico Adv. Aug. 26.	Aug. 26
Oct. 1.	Pensacola, Fla.	Aug. 12
Oct. 2.	Port Orchard, Wash.	Sep. 2
Oct. 3.	Bermuda, La.	Sep. 2
Oct. 4.	Superstructure, Chicago, Ill.	Aug. 12
Oct. 4.	Substructure, Chicago, Ill	Aug. 12

PAVING AND ROADMAKING.

Sep. 5.	Norwalk, O.	Aug. 5
Sep. 5.	Harrison, N. J.	Aug. 12
Sep. 5.	Columbus, O.	Aug. 12
Sep. 5.	Cincinnati, O.	Aug. 12
Sep. 5.	Bellevue, Pa.	Aug. 26
Sep. 5.	Brownstown, Ind.	Aug. 26
Sep. 5.	Toledo, O.	Aug. 26
Sep. 5.	Bisbee, Ariz.	Aug. 26
Sep. 5.	Wilmington, Del.	Aug. 26
Sep. 5.	Bayonne, N. J. Adv. Aug. 26.	Aug. 26
Sep. 5.	Albany, N. Y	Sep. 2
Sep. 5.	Rensselaer, N. Y.	Sep. 2
Sep. 5.	East Palestine, O.	Sep. 2
Sep. 5.	Everett, Mass.	Sep. 2
Sep. 5.	West Orange, N. J	Sep. 2
Sep. 6.	Cincinnati, O.	Aug. 19
Sep. 6.	Mercer, Pa.	Aug. 26
Sep. 6.	Providence, R. I.	Aug. 26
Sep. 6.	Dayton, O.	Aug. 26
Sep. 6.	Niles, Mich.	Sep. 2
Sep. 6.	Indianapolis, Ind.	Sep. 2
Sep. 7.	Brooklyn, N. Y.	Aug. 26
Sep. 7.	Iola, Kan.	Aug. 26
Sep. 7.	Memphis, Tenn.	Sep. 2
Sep. 7.	Towson, Md.	Sep. 2
Sep. 8.	Waukegan, Ill. Adv. Sept. 2.	Sep. 2
Sep. 8.	Ashland, O.	Sep. 2
Sep. 9.	Helena, Mont.	Sep. 2
Sep. 9.	Washington, Ind.	Sep. 2
Sep. 9.	Boise, Idaho	Sep. 2
Sep. 10.	Shelbina, Mo.	Aug. 19
Sep. 11.	Janesville, Wis.	Aug. 19
Sep. 11.	South Orange, N. J	Aug. 26
Sep. 11.	Harrisburg, Pa.	Sep. 2
Sep. 11.	Washington, N. C.	Sep. 2
Sep. 12.	Crookston, Minn. Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 12.	Green Bay, Wis.	Sep. 2
Sep. 12.	Rockville, Md.	Sep. 2
Sep. 13.	Brooklyn, N. Y.	Sep. 2
Sep. 13.	Indianapolis Ind.	Sep. 2
Sep. 14.	Brazil, Ind.	Sep. 2
Sep. 15.	Cincinnati, O.	Aug. 10
Sep. 15.	Brownstown, Ind.	Sep. 2
Sep. 16.	Ottawa, O.	Sep. 2
Sep. 18.	Willoughby, O.	Aug. 26
Sep. 18.	Napoleon, O.	Sep. 2
Sep. 18.	Lima, O.	Sep. 2
Sep. 22.	Madisonville, O.	Sep. 2
Sep. 23.	Little Rock, Ark.	Sep. 2
Sep. —.	Macon, Mo.	Sep. 2
Oct. 4.	Steelton, Pa. Adv. Sep. 2.	Sep. 2
———	Seattle, Wash.	Sep. 2

POWER, GAS AND ELECTRICITY.

Sep. 5.	Supplies, Washington, D. C.	Aug. 12
Sep. 5.	Washington, D. C.	Aug. 26
Sep. 5.	Burlington, Wis.	Aug. 26
Sep. 6.	Ukiah, Cal.	Aug. 5
Sep. 6.	Mendota, Wis.	Sep. 2
Sep. 8.	Ft. Snelling, Minn.	Sep. 2
Sep. 8.	Chicago, Ill.	Sep. 2
Sep. 9.	Dana, Ind. Adv. Sep. 2.	Sep. 2
Sep. 11.	Knoxville, Tenn.	Sep. 2
Sep. 12.	Washington, D. C.	Sep. 2
Sep. 15.	La Grange, Ga. Adv. Aug. 12 to 26.	Aug. 26
Sep. 18.	Ft. Myer, Va. Adv. Sept. 2.	Sep. 2
Sep. 19.	Washington, D. C.	Aug. 26
Sep. 27.	Baltimore, Md Adv. Sept. 2.	Sep. 2
Sep. 30.	Washington, D. C. Adv. Aug. 5.	Aug. 5
Oct. 1.	Tacoma, Wash.	Jul. 8
Oct. 4.	Jacksonville, Fla.	Sep. 2
Oct. 11.	Lockport, Ill.	Aug. 19
Oct. 15.	Reading, O.	Aug. 26
Dec. 2.	San Juan, Porto Rico	Aug. 19

BUILDINGS.

Sep. 5.	School, Salem, Ore.	Aug. 19
Sep. 5.	School, Hartford, Conn.	Aug. 26
Sep. 5.	Pub. bldg., New York, N. Y	Aug. 26
Sep. 5.	School, Brooklyn, N. Y	Aug. 26
Sep. 5.	Hospital improv., Sonyea, N. Y	Aug. 26
Sep. 5.	Jail, Kendall, Mont.	Sep. 2
Sep. 5.	Bus. bldg., Paducah, Ky.	Sep. 2
Sep. 5.	School, Elma, Ia.	Sep. 2
Sep. 5.	School, Guelph, Ont.	Sep. 2
Sep. 5.	Plumb., etc., in armory, Buffalo, N. Y.	Sep. 2
Sep. 5.	School, Tioga, Tex.	Sep. 2
Sep. 7.	Hospital, Jersey City, N. J	Aug. 12
Sep. 7.	School, Toledo, O.	Aug. 19
Sep. 7.	Library, Appleton, Wis.	Sep. 2
Sep. 7.	School, Saginaw, West Side, Mich	Sep. 2
Sep. 7.	Plmbg., etc., Pub. Bldg., Chicago, Ill.	Sep. 2
Sep. 7.	Library, Cleveland, O.	Sep. 2
Sep. 8.	Hospital, Whipple Barracks, Ariz Adv. Aug. 19 to Sep. 2.	Aug. 19
Sep. 8.	Pub. bldgs., Worcester, Mass	Sep. 2
Sep. 9.	Pub. bldg., Philadelphia, Pa.	Aug. 12
Sep. 9.	School, Fayetteville, Ark.	Aug. 26
Sep. 9.	Pub. bldg., Williamsport, O.	Sep. 2
Sep. 9.	Church, Athens, Ga.	Sep. 2
Sep. 11.	Post Bldgs., San Francisco. Cal	Aug. 19
Sep. 11.	City hall, etc., Galesburg, Ill	Sep. 2
Sep. 11.	Gas fit., etc., school, Long Island City, L. I., N. Y.	Sep. 2
Sep. 11.	Bus. bldg., Grand Rapids, Mich	Sep. 2
Sep. 11.	School, Ft. Wayne, Ind.	Sep. 2
Sep. 11.	School, Wellston, O.	Sep. 2
Sep. 11.	Htg., etc., school, New York, N. Y.	Sep. 2
Sep. 11.	School, Maynard, O.	Sep. 2
Sep. 11.	Jail, Oklahoma City, Okla. Ter	Sep. 2
Sep. 12.	School, Washington, D. C.	Sep. 2
Sep. 12.	Pub. Bldg., Seattle, Wash	Sep. 2
Sep. 12.	Iron balconies for hospital, New York, N. Y.	Sep. 2
Sep. 12.	School, Galesville, Wis.	Sep. 2
Sep. 13.	Pub. Bldgs., Baltimore, Md	Aug. 19
Sep. 14.	Bus. bldg., St. Louis, Mo	Aug. 5
Sep. 14.	Lighthouse, Ft. Schuyler, N. Y Adv. Aug. 12, 19.	Aug. 12
Sep. 14.	School, Shawnee, Okla. Ter	Aug. 26
Sep. 15.	Pub. bldg., material, Ft. Totten, N. Y., Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 15.	Bus. bldg., Okeene, Okla. Ter	Aug. 26
Sep. 16.	Pub. bldg., Cleveland, O	Aug. 26
Sep. 16.	Pub. bldg., Chicago, Ill	Sep. 2
Sep. 18.	Pub. bldg., Duluth, Minn Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 18.	Pub. Bldg., Erie, Pa	Aug. 26
Sep. 19.	Capitol, Bismarck, N. D.	Aug. 19
Sep. 19.	Bldg. material, Crowcreek, S. D	Sep. 2
Sep. 20.	Court House, Akron, O.	Aug. 19
Sep. 20.	Schools, Jocko, Mont.	Sep. 2
Sep. 20.	Furnace, P. O., Washington, D. C.	Sep. 2
Sep. 22.	School, Oneida, Wis.	Aug. 26
Sep. 24.	Freight house, Dayton, O.	Sep. 2
Sep. 28.	School, Washington, D. C	Sep. 2
Sep. 28.	Boiler, etc., Pub. Bldgs., Baltimore, Md.	Sep. 2
Sep. 30.	Htg., etc., pub. bldg., Washington, D. C. Adv. Aug. 5 to Sept. 2	Aug. 5
Sep. 30.	Mess hall, etc., Washington, D. C. Adv. Sep. 2.	Sep. 2
Sep. 30.	Pub. Bldg. New York N. Y	Sep. 2
Oct. 1.	Hospital, Memphis, Tenn.	Aug. 26
Oct. 1.	Fire headquarters, Kansas City, Mo.	Sep. 2
Oct. 2.	Repairing court house, Rosedale, Miss.	Aug. 26
Oct. 2.	Htg. jail, Cleveland, Miss	Aug. 26
Oct. 5.	Courthouse, Manhattan, Kan.	Aug. 12
Oct. 16.	Court house, Gretna, La.	Sep. 2
———	School, Santa Fe,, N. M	Sep. 2
———	School, Lawrence, Kan.	Sep. 2
———	Church, Ft. Worth, Tex	Sep. 2

MISCELLANEOUS.

Sep. 5.	Dredging, Oakland, Cal Adv. Aug. 5 to 26.	Aug. 5
Sep. 5.	Supplies, Washington, D. C	Aug. 12
Sep. 5.	Dredging, Mobile, Ala. Adv. Aug. 12 to 26.	Aug. 12
Sep. 5.	Canal, Miami, Fla. Adv. Aug. 12 to 26.	Aug. 12
Sep. 5.	Cement, Billings, Mont. Adv. Aug. 19 to Sep. 2.	Aug. 19
Sep. 5.	Supplies, Washington, D. C.	Aug. 26
Sep. 5.	Dam, Findlay, O.	Sep. 2
Sep. 6.	Breakwater, Petoskey, Mich. Adv. Aug. 12 to Sep. 2.	Aug. 12
Sep. 6.	Culverts, Cleveland, O.	Aug. 19
Sep. 6.	Drain, etc., New Brighton, S. I., N. Y.	Aug. 26
Sep. 7.	Dredging, New York, N. Y Adv. Aug. 12 to Sep. 2.	Aug. 12
Sep. 7.	Cement, etc., Brooklyn, N. Y	Aug. 26
Sep. 7.	Supplies, New York, N. Y	Aug. 26
Sep. 7.	Levee work, New Orleans, La	Sep. 2
Sep. 8.	Dredge pumps, etc., St. Louis, Mo Adv. Aug. 12 to Sep. 2.	Aug. 12
Sep. 8.	Dredging, Nat'l Soldiers' Home, Va.	Aug. 26
Sep. 8.	Ditch, etc., Ft. Snelling, Minn	Sep. 2
Sep. 9.	R. R. work, Miami, Fla Adv. Jul. 15 to Sep. 2.	Jul., 29
Sep. 9.	Derrick, Guantanamo, Cuba	Aug. 12
Sep. 9.	Dredging, Charleston, S. C Adv. Aug. 12 to Sep. 2.	Aug. 12
Sep. 9.	Canal, Forrest City, Ark	Aug. 19
Sep. 9.	Pier Boston Mass.	Aug. 19
Sep. 9.	Dredge, New Orleans, La	Aug. 19
Sep. 9.	Dredging, New York, N. Y Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 9.	Ditch, Ft. Dodge, Ia	Aug. 26
Sep. 9.	R. R. work, Charleston, W. Va	Sep. 2
Sep. 11.	Ditch, Des Moines, Ia.	Aug. 26
Sep. 11.	Wall, Chicago, Ill.	Sep. 2
Sep. 12.	Crane, San Francisco, Cal	Aug. 12
Sep. 12.	Machine tools, etc., New Orleans, La.	Aug. 12
Sep. 12.	Dredging, New York, N. Y (2 prop.) Adv. Aug. 19 to Sep. 2.	Aug. 19
Sep. 12.	Cement, Panama	Aug. 26
Sep. 12.	Supplies, Washington, D. C	Sep. 2
Sep. 13.	Machine tools, etc., Panama	Aug. 19
Sep. 14.	Levee, England, Ark.	Aug. 26
Sep. 14.	Jetty work, Newport, R. I Adv. Sep. 2.	Sep. 2
Sep. 14.	Dredging, New York, N. Y	Sep. 2
Sep. 15.	Excav. canal, Riverton, Ala Adv. Aug. 19 to Sep. 2.	Aug. 19
Sep. 15.	R. R. work, Charleston, W. Va	Sep. 2
Sep. 15.	Drain, Boone, Ia.	Sep. 2
Sep. 16.	Hoist, New York, N. Y	Aug. 12
Sep. 18.	Sweeping machine, Sherman, Tex Adv. Sept. 2.	Sep. 2
Sep. 18.	El. Ry. Woodland Cal.	Sep. 2
Sep. 19.	Supplies, Washington, D. C	Aug. 26
Sep. 19.	Ditch work, Council Bluffs, Ia Adv. Sept. 2.	Sep. 2
Sep. 20.	Pier improv., Charlevoix, Mich Adv. Aug. 26 to Sep. 2.	Aug. 26
Sep. 20.	Rock excav., Pawtucket, R. I Adv. Sep. 2.	Sep. 2
Sep. 20.	Park work Baltimore Md.	Sep. 2
Sep. 22.	Dam improv., Wheeling, W. Va	Aug. 26
Sep. 22.	Supplies, Panama	Sep. 2
Sep. 23.	Ditch, Des Moines Ia.	Sep. 2
Sep. 26.	Telephone, Washington, D. C	Sep. 2
Sep. 26.	Cement, Billings, Mont. Adv. Sept. 2.	Sep. 2
Sep. 26.	Elevators, Baltimore, Md. Adv. Sep. 2.	Sep. 2
Sep. 30.	Crane track, Boston, Mass.	Sep. 2
Oct. 3.	Supplies, San Francisco, Cal	Aug. 26
Oct. 25.	Dock, Chicago, Ill.	Sep. 2
Nov. 6.	Garb. disp., New York, N. Y	Sep. 2
Nov. 9.	Wharf, etc., Havana, Cuba	Jul. 29
Dec. 1.	R. R. work, Manila, P. I	Sep. 2
Jan. 1.	Statue plans, Indianapolis, Ind	Jul. 22
Apr. 2,	'06. Harbor Work, Valparaiso, Chili, Adv. Apr. 29 to Sep. 2.	Apr. 29
———	R. R. work, Providence, Ky	Aug. 26
———	Excav., Indianapolis, Ind	Aug. 26